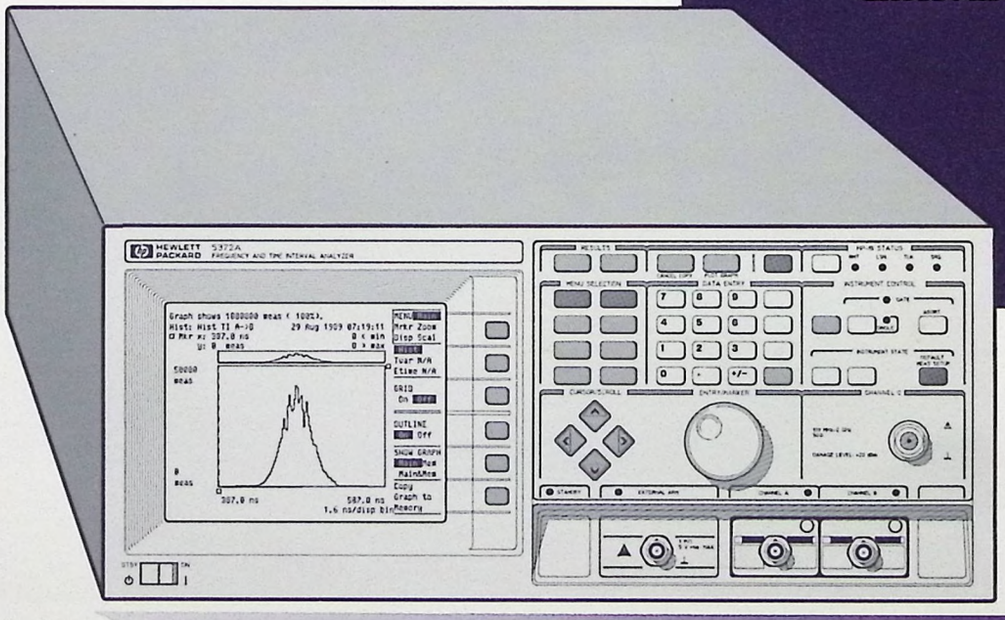
HEWLETT PACKARD

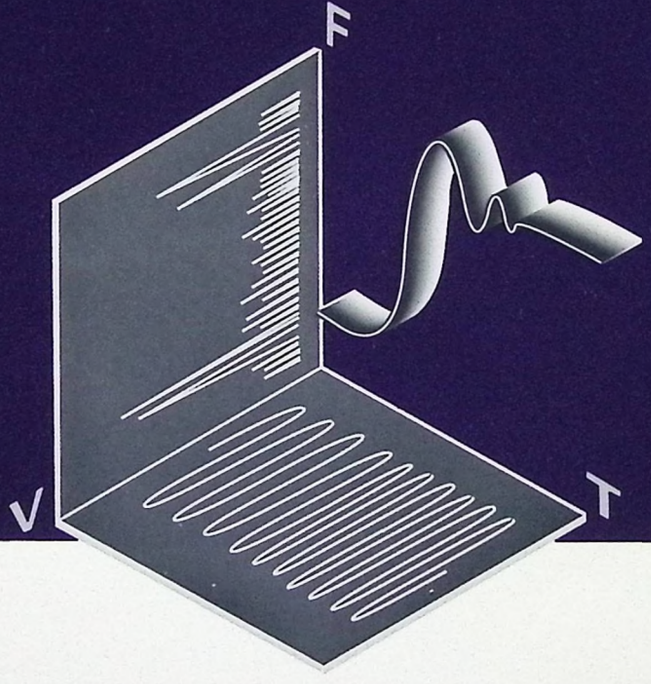
Getting Started Guide

HP 5372A
Frequency and Time Interval Analyzer



The Modulation Domain:

A view of frequency, phase, or time interval measurements versus time . . .



HP 5372A
Front Panel Features

RESULTS — Keys for displaying numeric and graphic measurement results.

MENU SELECTION — Keys for selecting main menus.

Keys for displaying summary of instrument settings, and for printing and plotting display screen contents.

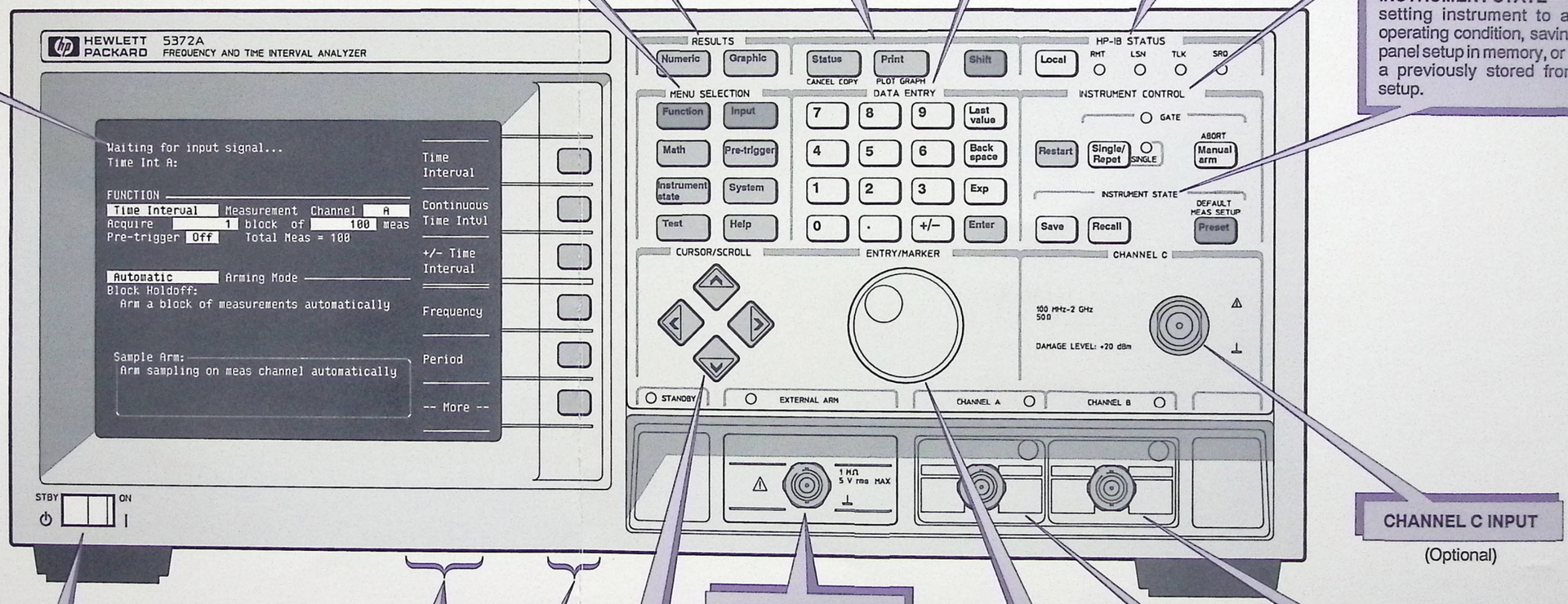
DATA ENTRY — Keys for entering or modifying numbers in numeric menu fields. Entry/Marker knob changes numeric entries by smallest increment available.

HP-IB STATUS — Key for returning instrument to front panel control from remote and LEDs to monitor remote control operation.

INSTRUMENT CONTROL — Keys for restarting a measurement, clearing results and error messages, selecting single measurement mode, and for manual control of the measurement gate.

INSTRUMENT STATE — Keys for setting instrument to a known operating condition, saving a front panel setup in memory, or recalling a previously stored front panel setup.

STATUS LINE — Displays operating status, advisory messages, and error conditions.



MEASUREMENT LINES — Displays abridged measurement results for up to two channels simultaneously.

DATA AREA — First line displays the menu title currently selected. The area below can show measurement setups, instrument configuration, help messages, math constants, measurement results, memory contents, status summary, and diagnostics.

POWER SWITCH

SOFTKEY AREA — Displays the available options for the menu field selected by the menu cursor.

Softkeys for selecting menu options.

CURSOR/SCROLL — Keys for moving the menu cursor among the menu fields in the Data Area. The highlighted field determines the softkey menu options appearing in the softkey area. Scrolls measurement results on the Numeric screen and graphs on the Graph screen.

EXTERNAL ARM INPUT

ENTRY/MARKER — Knob for moving markers on the Graphic Screen, modifying numeric field entries, and scrolling measurement results on the Numeric screen.

CHANNEL A INPUT

CHANNEL B INPUT

CHANNEL C INPUT
(Optional)

Getting Started Guide

HP 5372A
Frequency and Time Interval Analyzer

First Edition

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5301 Stevens Creek Boulevard • Santa Clara, California 95052

Printed: SEPTEMBER 1989

HEWLETT PACKARD

Safety Considerations

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

This product is a Safety Class I instrument (provided with a protective earth terminal).

BEFORE APPLYING POWER

Verify that the product is set to match the available line voltage and the correct fuse is installed. Refer to instructions in appendix B.

SAFETY EARTH GROUND

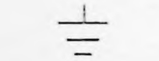
An uninterruptible safety earth ground must be provided from the mains power source to the product input wiring terminals or supplied power cable.

Safety Symbols

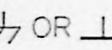
Instruction manual symbol; the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual.

Indicates hazardous voltages.

Indicates earth (ground) terminal.



Indicates terminal is connected to chassis when such connection is not apparent.



Alternating current.

Direct current.

WARNING

THIS DENOTES A HAZARD. IT CALLS ATTENTION TO A PROCEDURE, PRACTICE, OR THE LIKE, WHICH, IF NOT CORRECTLY PERFORMED OR ADHERED TO, COULD RESULT IN PERSONAL INJURY. DO NOT PROCEED BEYOND A *WARNING* SIGN UNTIL THE INDICATED CONDITIONS ARE FULLY UNDERSTOOD AND MET.

CAUTION

This denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a *CAUTION* sign until the indicated conditions are fully understood and met.

Safety Information

WARNING

Any interruption of the protective grounding conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection.)

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If this instrument is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to the earthed pole terminal (neutral) of the power source.

Instructions for adjustments while covers are removed and for servicing are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform such adjustments or servicing unless qualified to do so.

For continued protection against fire, replace the line fuse(s) only with 250V fuse(s) of the same current rating and type (for example, normal blow, time delay). Do not use repaired fuses or short circuited fuseholders.

When measuring power line signals, be extremely careful and always use a step-down isolation transformer whose output voltage is compatible with the input measurement capabilities of this product. This product's front and rear panels are typically at earth ground, so NEVER TRY TO MEASURE AC POWER LINE SIGNALS WITHOUT AN ISOLATION TRANSFORMER.

TABLE OF CONTENTS

APPENDIX B
UNPACKING AND
INSTALLING

1

WHAT IS THE HP 5372A?

INTRODUCTION

The Hewlett-Packard 5372A Frequency and Time Interval Analyzer provides flexibility and high performance for frequency and time measurements. It has full HP-IB programmability and a powerful feature set for a wide range of applications.

THE KEY FEATURES

The HP 5372A key features include:

- Continuous measurements at up to a 13.3 MHz rate
- DC to 500 MHz frequency range (2 GHz with optional input channel)
- –4.0 to +4.0 second time interval range
- Selection of input pods: 50 Ω, 1 MΩ, or 10 kΩ active probe
- Measurement arming by signal edge, time, or events
- Pre-trigger for frequency and time interval measurements
- Averaging for measurements to increase resolution
- Selectable hysteresis for measurements on noisy signals
- Single-channel phase measurement (Phase Deviation function)
- Cumulative time jitter measurement (Time Deviation function)
- Histogram measurements utilizing hardware processing for acquiring and analyzing very large sample sizes quickly

THE ANALYSIS FEATURES

The HP 5372A has a powerful set of analysis features. It includes:

- Time Variation graph of measurements: frequency vs. time, time interval vs. time, and phase vs. time
- Histogram graph
- Event Timing graph
- Limit testing
- Statistics: mean, minimum, maximum, standard deviation, variance, rms, Allan variance, root Allan variance
- Modulation values (peak-to-peak deviation, center frequency, modulation rate)
- Window Margin Analysis

2

MAKING A MEASUREMENT

CHAPTER OVERVIEW

This chapter demonstrates how to start using the HP 5372A to make measurements. The items covered in this chapter are:

- Front-panel layout
- Power-up
- How to modify menu parameters
- Making some basic measurements
- Altering how you can start and stop measurements
- A guide for making measurement setups

A LOOK AT THE FRONT PANEL

This brief look at the front panel in *Figure 2-1* concentrates on the groups of keys used most often in operating the HP 5372A. A detailed explanation of each front-panel feature can be found in, "Front Panel/Rear Panel," chapter 6 of *Operating Manual*.

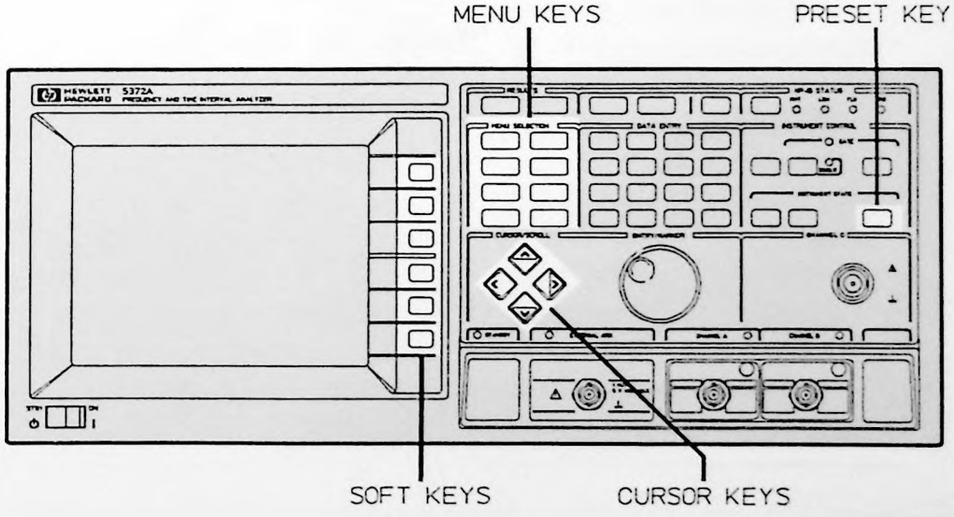


Figure 2-1.
Selected front-panel keys

SWITCHING ON THE HP 5372A

This procedure assumes the HP 5372A is already plugged into the correct ac power source. If not, refer to appendix B, "Unpacking and Installing," and then return to this point.

1. Set the power switch to ON.

The Analyzer executes some internal tests to verify basic functionality. During this time the display shows, "PERFORMING SELF TEST..."

The display warm-up and instrument self-test normally take 10-15 seconds. Refer to "Test Menu," chapter 13 of *Operating Manual*, for a listing of the power-up tests. When testing is completed, the Function menu is displayed, and the HP 5372A is ready to use.

TECHNICAL COMMENT

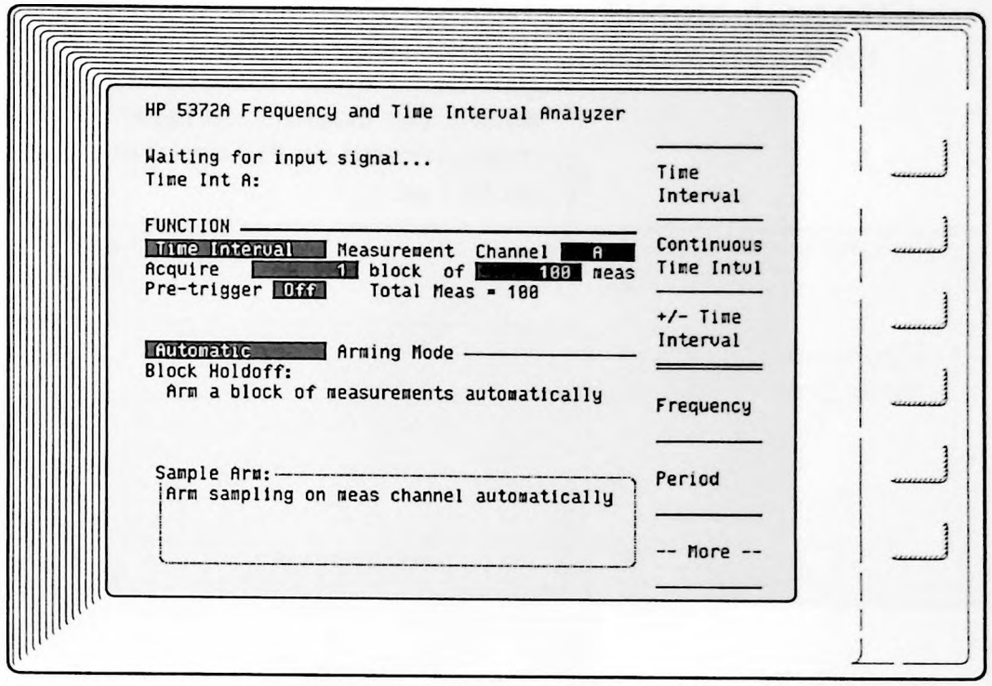
Battery Backup Feature — The HP 5372A can save measurement setups in memory. This information is preserved by battery power when the instrument is set to Standby or is disconnected from a power source. The battery will preserve stored setups for up to six months with power disconnected from the 5372A.

At the completion of the power-up procedure, the last measurement setup before the power was interrupted is recalled and the measurement is restarted. The measurement and display memories are cleared, so no past data is preserved.

2. Disconnect any input signal and press the green **Preset** key.

This sets the HP 5372A to its default operating condition. The Function menu is displayed and should look identical to the one shown in *Figure* 2-2.

Figure 2-2. Preset Function Menu



TECHNICAL COMMENT

Pressing the **Preset** *key at any time brings you back to the default instrument state. Use the* **Preset** *key to quickly reset the HP 5372A parameters to their default setting. If you should ever press the* **Preset** *key by mistake, your last instrument setup can be retrieved by pressing the* **Recall** *key and "0" on the DATA ENTRY keypad. The instrument setup at the time Preset is selected is saved in storage register "0". Automatic storage of the current instrument setup also occurs for the Default Measurement Setup feature. The* **DEFAULT MEAS SETUP** *(selected by* **Shift** *key +* **Preset** *key) automatically configures the HP 5372A to make measurements and display the results for whatever measurement function is selected at the time. For more information on saving and recalling instrument setups, refer to, "Instrument State Menu," chapter 11 of* Operating Manual. *For a listing of the parameters selected by the Preset function or the Default Measurement Setup function, refer to, "Front Panel/Rear Panel," chapter 6 of* Operating Manual.

HOW TO CHANGE MENU PARAMETERS

Menu parameters specify how the HP 5372A will operate. These parameters are inside the inverse video rectangles on the menu screens. These rectangles are called "fields" and are referenced by the words preceding or following them on the screen. For example, in *Figure 2-3*, the **Channel** field is set for a measurement on the signal at Channel A, the **intervals** field is set to 1 μs.

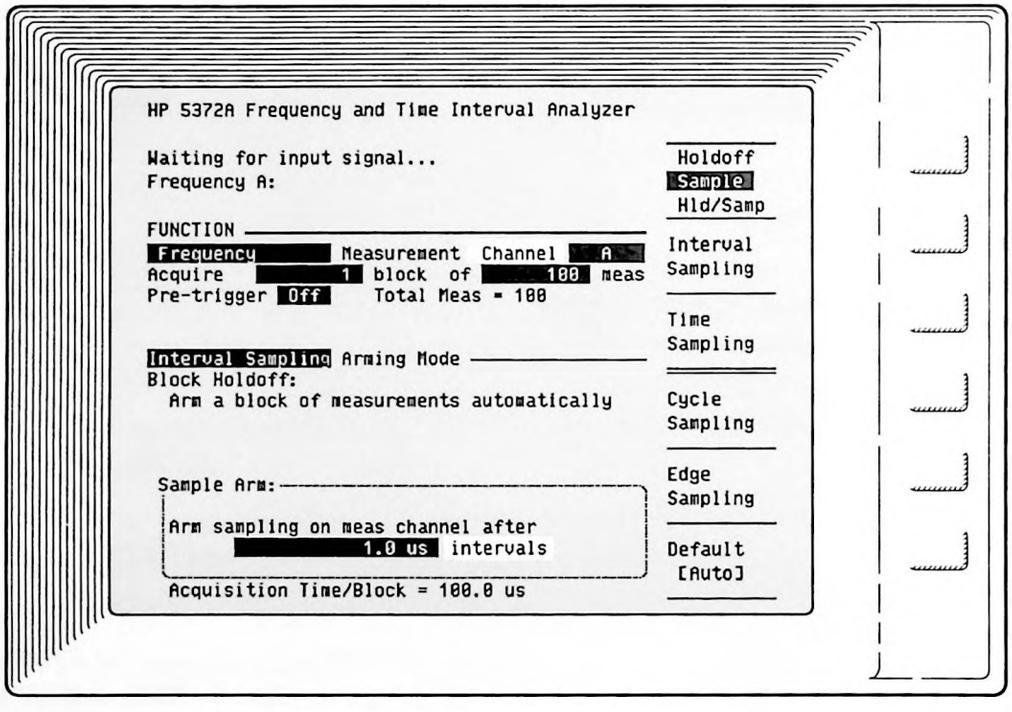


Figure 2-3. Menu Screen

Three Steps to Change Parameter

There are three steps to change a menu parameter, as shown in *Figure 2-4*:

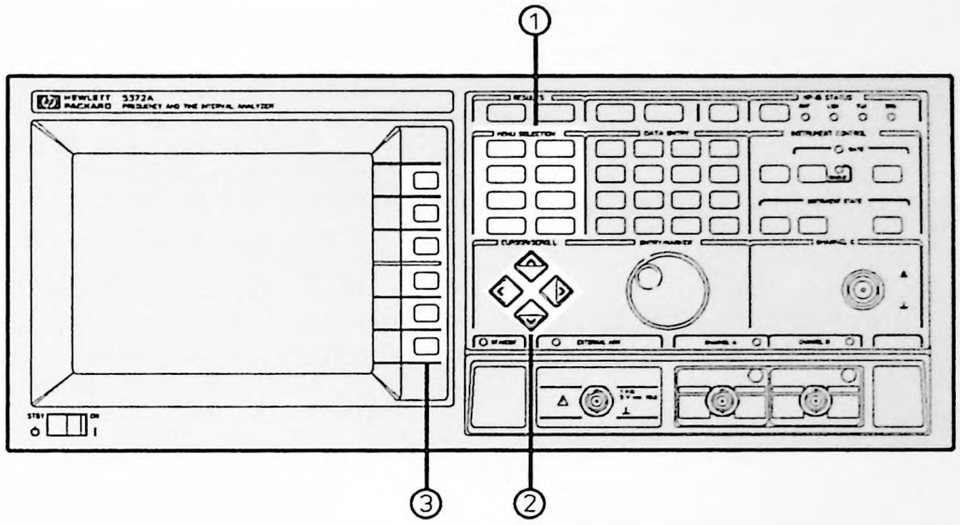


Figure 2-4.
3 Steps to Change a Menu Parameter

Step One

Select a menu with the Menu Selection hardkeys.

Step Two

Use the Cursor/Scroll keys to move the menu cursor to the field you want to modify.

Step Three

Use the softkeys to select the desired option from the list at the right-hand edge of the display.

Softkey Operation

Where a softkey presents more than one option, the active option is shown in inverse video. Pressing the softkey will cause the next option to become active. The inverse video always highlights the current selection. Where all options for a field do not fit on one "page" of softkeys, a **More** softkey appears to allow access to additional choices. *Figure 2-5* shows a page of softkeys from the Graphics screen. The softkey options shown here are described in, "Graphic Results," chapter 16 of *Operating Manual*.

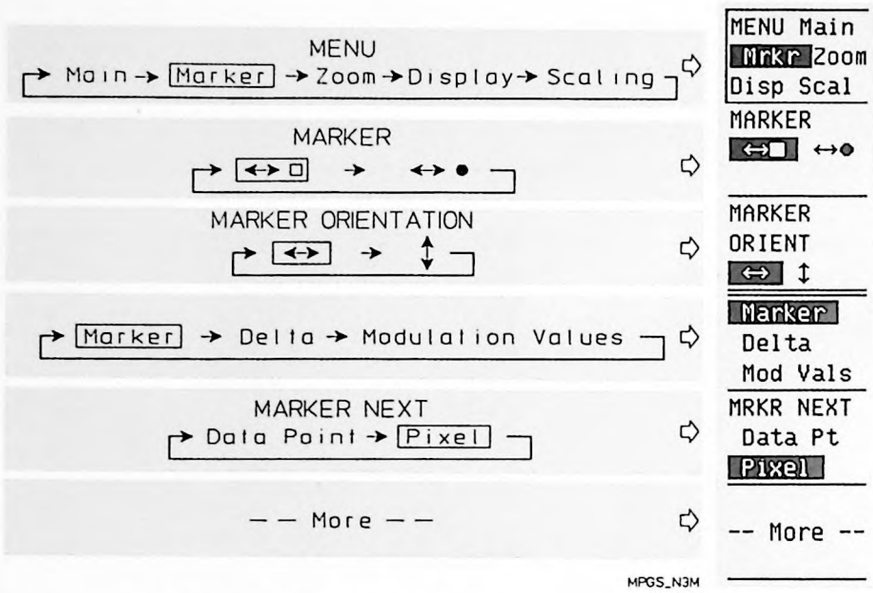


Figure 2-5. Page of Graphic Softkeys

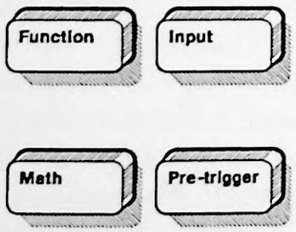
MENUS

The Menu Selection keys give you access to the main functions of the HP 5372A.The menus can be divided into three groups:

- Measurement setup
- Instrument management
- Operating information

The menu keys will be discussed briefly here. If you want more information on any of the menus, consult *Operating Manual*. Select each of the menus on the front panel as you read the following menu descriptions.

Measurement Setup Menus



There are four menus for setting up a measurement:

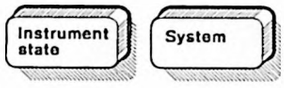
- **Function** is for selecting the measurement, its size, and how you want it to start and stop.
- **Pre-trigger** is used when you want to capture measurement data occurring prior to a specified time interval or external event. Data occurring before and/or after this event can be measured and analyzed.
- **Input** is for setting the conditions under which the HP 5372A will trigger on the input signal. A trigger event occurs when the input signal satisfies two conditions

defined on this menu. One condition is the slope of the input signal, the other is a specific voltage of the input signal. The HP 5372A will trigger on a positive (rising) or negative (falling) slope of the signal.The voltage at which the instrument will trigger can be specified as a voltage level or a percentage of peak-to-peak voltage.

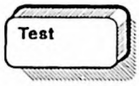
- **Math** is used to select post-measurement processing features such as statistics, math processing features such as offset or scale, and limit testing values.

Instrument Management Menus

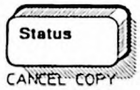
These menus provide control of features separate from measurement setup.



- **Instrument State** lets you view saved instrument setup functions and protect storage registers from accidental over-writing
- **System** contains:
  - HP-IB mode and address selection
  - Status of instrument options
  - Measurement data width selection
  - System clock



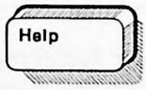
- **Test** provides control of some operational checks and diagnostic tests for the use of a trained service technician



- **Status** gives a summary of the current instrument settings The summary includes the settings of the:
  - Function menu
  - Input menu
  - Math menu
  - Pre-trigger menu

Operating Information Menu

Help provides operating information on the following topics:



- Function menu
- Input menu
- Math menu
- Pre-trigger menu
- Results
- User interface
- Graphs
- HP-IB
- Test menu

NOW MAKE A MEASUREMENT

You can use an output signal from the rear panel to get started making measurements. Using this procedure you can make some measurements and review the results.

1. Press the **Preset** key to return the HP 5372A to the default state.

2. Connect the Frequency Standard output from the rear panel to the Channel A Input as shown in *Figure 2-6*.

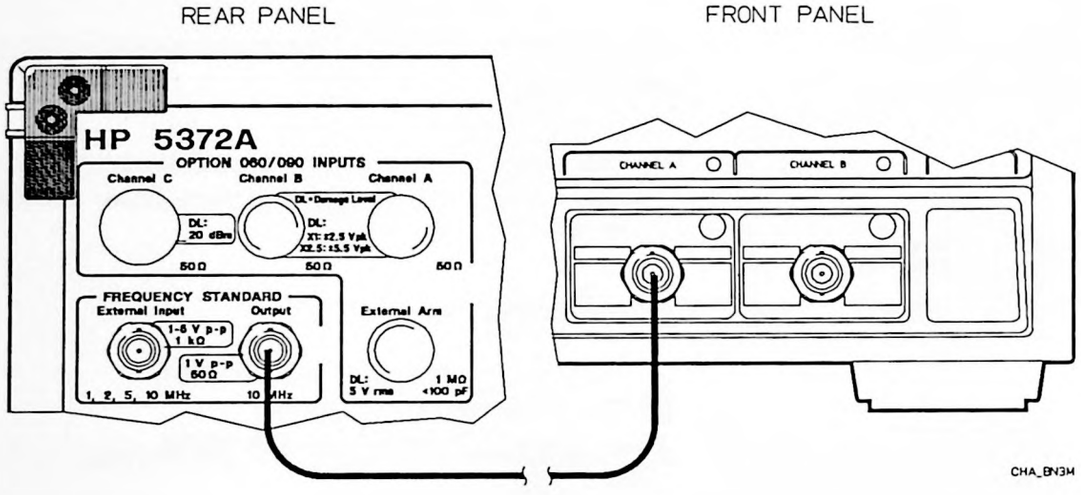
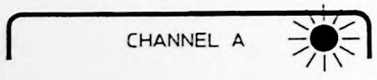


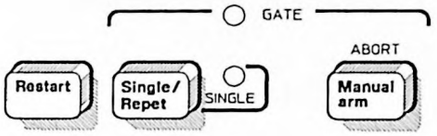
Figure 2-6. Cable Connection for First Measurement



3. Notice that the LED above the Channel A Input Pod starts flashing. It indicates that there is a signal at Channel A triggering the input circuitry. Use the LEDs near the input pods as your first indication of the presence of an input signal to the HP 5372A. The input pods are interchangeable and can be selected according to the measurement application. Refer to, "Input Menu," chapter 8 of *Operating Manual* for more information on the input pods.

TECHNICAL COMMENT

If you connect a signal to Channel A, B, or External Arm, and the input LED does not start flashing, first check the Trigger Event settings on the Input menu. The trigger level may be set incorrectly for your signal. Then check your signal source to ensure that its output meets the input requirements of the HP 5372A (± 2 V limit with a 50 Ω input pod and the 1:1 attenuation setting).



4. Notice also the Gate LED located near the right-hand side of the HP 5372A under the words, INSTRUMENT CONTROL. The LED is illuminated whenever data is being acquired by the HP 5372A. For this setup selected by the **Preset** key, a measurement sequence consists of 100 measurements, as shown on the Function menu. Use the Gate LED to monitor the acquisition of data.

The HP 5372A is currently making 100 measurements at a time. As you can see on the Function menu, the text reads, "Acquire 1 block of 100 meas." A block can consist of one measurement, or a block can be more than one measurement collected in a group. The Function menu only has space to show you one result. It is found near the top of the display. This result is always the first measurement of each block when you are collecting more than one measurement at a time. Next, you can see the other 99 results by using the measurement review features of the HP 5372A.

REVIEW THE RESULTS

The entire list of results is shown on the Numeric screen.

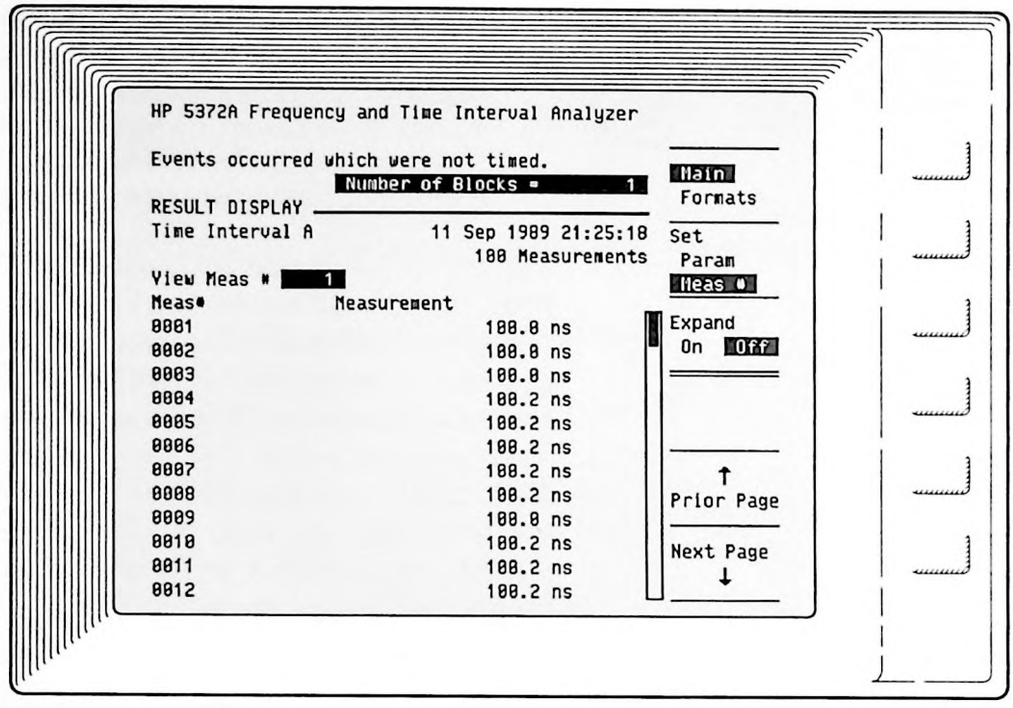
Numeric Results

1. To gain access to the 100 measurement results, press the Numeric key.

The first twelve results are displayed as in *Figure* 2-7.

2. Press the top softkey to select **Main**.

Figure 2-7.
Numeric Results



3. To see additional results, press the **Next Page** softkey. Press this softkey and the one above it. You can move forwards and backwards through your measurement results. Notice the indicator to the left of the softkey labels as you press the "Prior/Next" softkeys. It shows you the relative position of where you are in the list of results and the portion of the results currently displayed. The first measurement is at the top; the last is at the bottom.

There are two ways the data results can be scrolled:

- Entry/Marker knob

OR

-  and  Cursor/Scroll keys

Before using the knob to scroll the results, make sure the **Set Param/Meas #** softkey function is set to **Meas #**. A specific measurement result can be displayed by entering the number at the numeric keypad and pressing the **Enter** key to complete the entry.

Notice the field at the top of the display. This feature allows you to alter numeric entries normally found on other menu screens. This feature will be demonstrated later in this chapter.

Other Numeric Result Screens

There are additional screens for reviewing numeric results. The following steps display them.

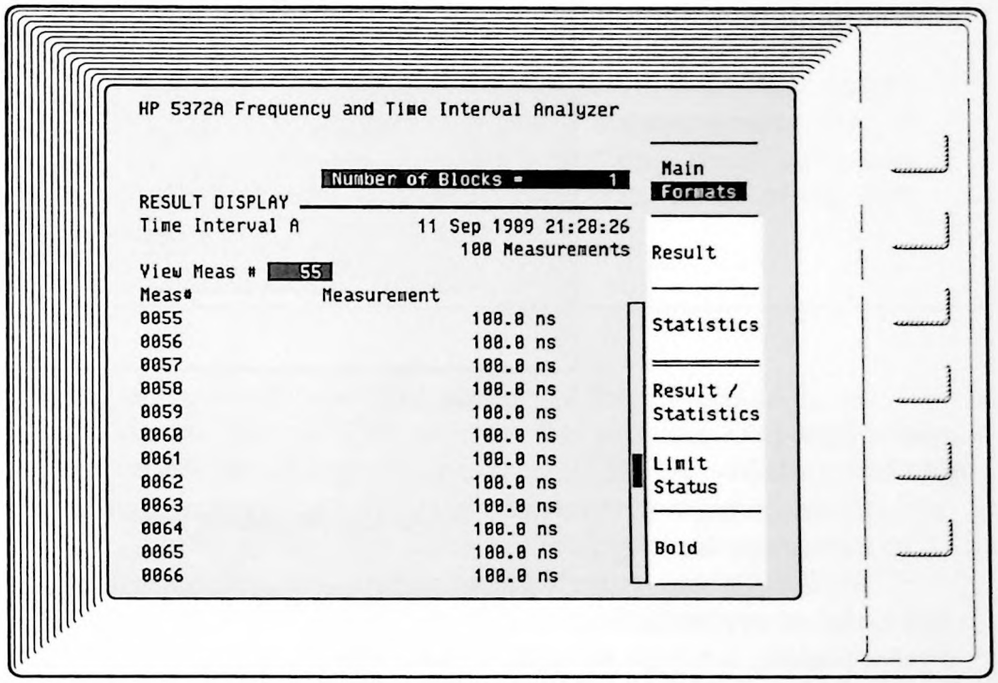


Figure 2-8. Numeric Screen Result Formats

1. Press the top softkey to select **Formats**.

The softkey labels show the options for the result displays as in *Figure 2-8*.

2. Press the **Statistics** softkey.

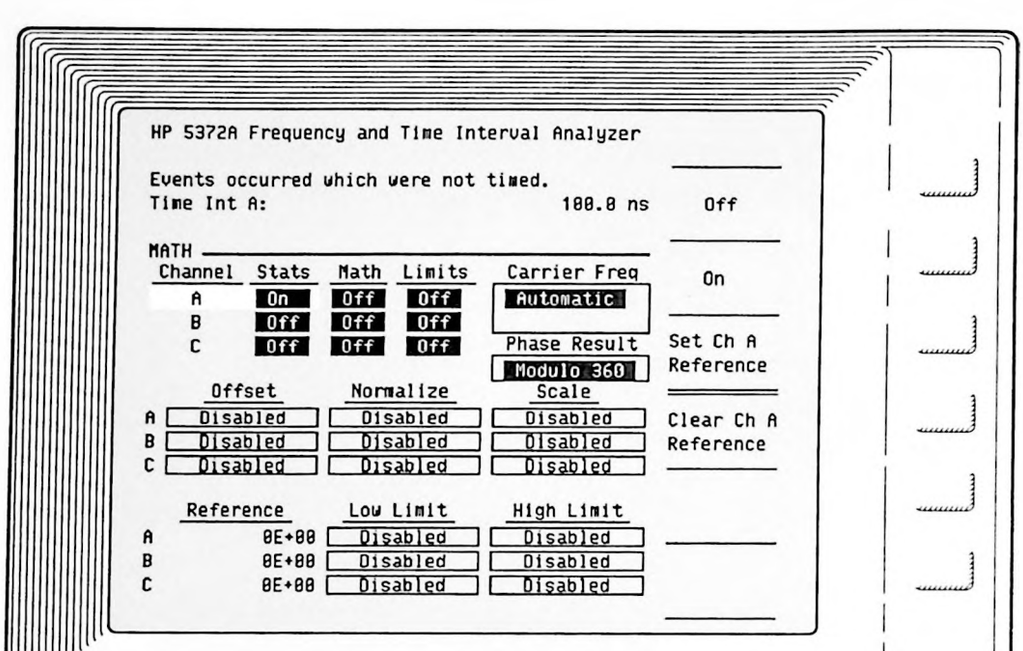
The message on the screen indicates that the statistics function is turned off. This feature is enabled on the Math menu. The next two steps demonstrate how to enable Statistics.

3. Press the **Math** key.

4. Make sure the Channel A **Stats** field is highlighted and then press the **On** softkey.

The statistics feature is enabled for Channel A. See *Figure 2-9*.

Figure 2-9.
Math Menu Showing Statistics On



5. Press the **Numeric** key.

Eight statistical values are displayed.

6. Press the **Result/Statistics** softkey.

You can now see eight measurement results and four statistical values.

7. Press the **Limit Status** softkey.

As you can see, Limits are disabled, but also accessible on the Math menu. The Limits feature is not demonstrated here. For more information, refer to, "Math Menu," chapter 9 of *Operating Manual.*

8. Press the **Bold** softkey.

One measurement result and two statistical values are displayed in an enlarged size for easy viewing.

MAKE A FREQUENCY MEASUREMENT

Up to now you have demonstrated features for reviewing data once it is collected. The next series of steps will have you modify the measurement function and other instrument parameters to control how the measurements are made.

1. Press the **Preset** key.

2. Change the measurement function to Frequency from Time Interval.

NOTE

Frequency may not be displayed as a softkey option when the menu cursor is at the **Measurement** *field. If not, just press the* **More** *softkey until you see* **Frequency** *as a softkey selection. Then press that softkey.*

CHANGE THE ARMING MODE

One of the most powerful aspects of the HP 5372A is its arming capability. With arming, it is possible to specify when and where on an input signal the HP 5372A will start and stop a measurement, or a series of consecutive measurements. For now, just be aware that there are four general categories of arming modes, and within each category are individual arming modes that present you with alternatives to select the amount of control you want to impose on your measurement. For detailed arming information, refer to "Arming," chapter 5 of *Operating Manual*.

The following procedure introduces you to arming through the use of a general-purpose arming mode.

1. Move the menu cursor to the **Arming Mode** field.

The next two steps will have you change the arming mode from Automatic to Interval Sampling.

TECHNICAL COMMENT

The Automatic arming mode lets the HP 5372A take samples on the measurement signal as quickly as possible. Interval Sampling is an arming mode that lets you control the rate at which samples of data are collected. See the figure below.

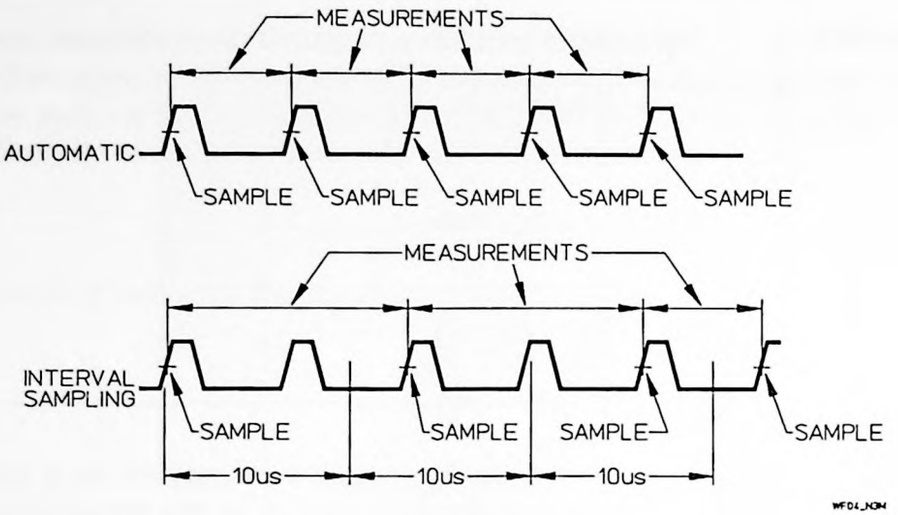


Figure 2-10. Automatic vs. Interval Sampling

2. Press the top softkey to select **Sample**.

3. Press the **Interval Sampling** softkey.

An interval of 10 microseconds is the default setting for this arming mode. Use of the Interval Sampling arming mode is similar to setting a gate time on a traditional counter. The HP 5372A differs from traditional counters in that these measurement intervals are continuous, or back-to-back.

4. Check the measurement result at the top of the display and note the increase in measurement resolution over the Automatic arming mode.

TECHNICAL COMMENT

Frequency Resolution — The resolution of your frequency results is determined by the input frequency and the interval between samples. The longer the sampling interval, the higher the resolution of the results. Figure 2-11 shows the single-shot resolution of the HP 5372A as a function of sampling interval and input frequency.

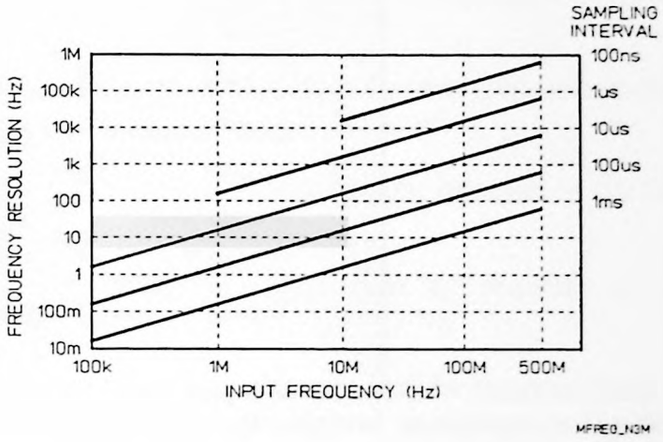
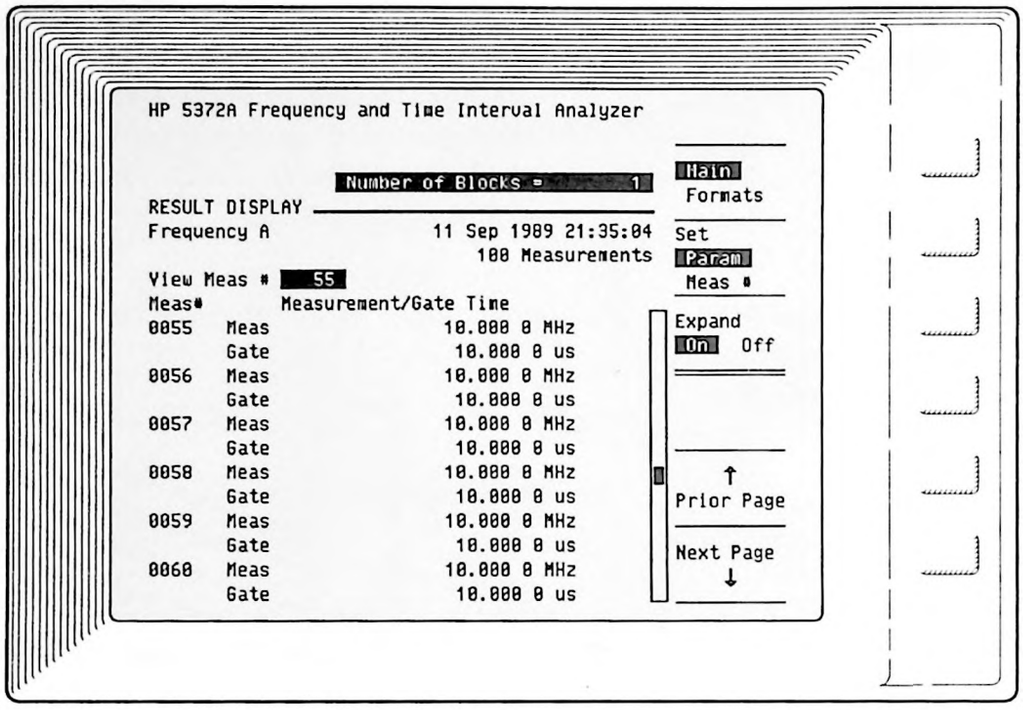


Figure 2-11. Frequency Resolution

For example, taking samples at 100 μs intervals on a 10 MHz input signal will yield a resolution of 10 Hz (10. 000 00 MHz).

5. Switch between **Automatic** (bottom softkey) and **Interval Sampling** while you observe the measurement result. Select **Interval Sampling** before continuing to the next step.
6. Go to the Numeric screen.
7. Press the top softkey to select **Main**.
8. Set the **Expand** feature to **On**.

Figure 2-12.
Gate Data Display



The elapsed time for each measurement is displayed after each measurement result as shown in *Figure 2-12*.

9. To see the gate time for measurements with Automatic arming, return to the Function menu, change the arming mode back to **Automatic**, and return to the Numeric screen.

The gate time for Automatic arming is 100 ns. This is the time over which the measurement was made. It is also the period of the 10 MHz signal. The HP 5372A is measuring 100 consecutive cycles of the 10 MHz signal.

CHANGE THE INTERVAL

Here you will further increase measurement resolution by lengthening the interval over which each measurement will be collected.

1. Go to the Function menu and set the arming mode to **Interval Sampling**.

2. Move the menu cursor to the **intervals** field.

The next two steps have you set the interval to 1 millisecond.

3. Press "1" on the DATA ENTRY keypad.

Notice the softkey choices now available.

4. Press the **ms** softkey and then go back to the Numeric screen.

The gate data now reflects the increased time over which each measurement is collected. Note that the gate time may not be exactly 1 ms.

In the next step you will use a field on the Numeric screen to again modify the interval.

5. Press the **Set** softkey to select **Param** (abbreviation of "Parameter") if not already selected.

Now you can enter a new value for the interval at the top of the display.

6. Press "1", then the **Exp** key, then "6", then the **+/–** key, and finally the **Enter** key.

A new block of 100 measurements will be immediately acquired with a 1 μs sample interval as shown in *Figure 2-13*.

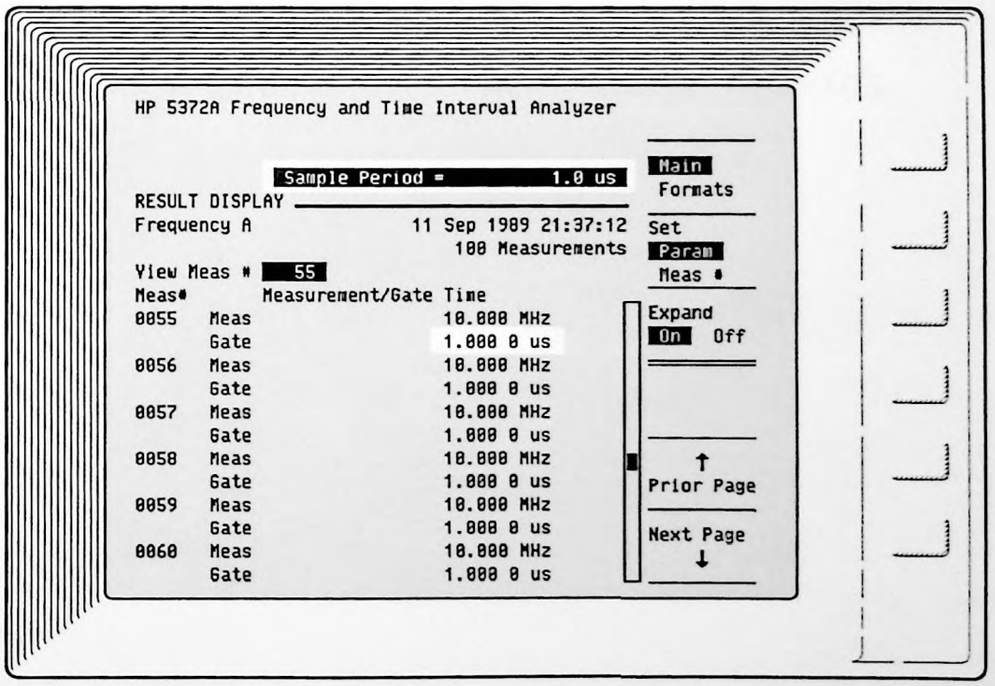
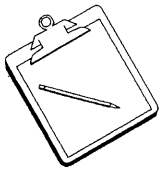


Figure 2-13. Parameter Field on the Numeric Screen

TECHNICAL COMMENT



It is possible to modify numeric entry fields from the Numeric screen. This is how it works: Whatever numeric entry field is selected by the menu cursor on the Function, Input, Math, or Pre-trigger menu is displayed at the top of the Numeric screen. The field will always reflect whichever was the last numeric field from one of these menus that was displayed. For example, go to the Input menu and set the menu cursor to a numeric entry field such as Trigger Event level. Return to the Numeric screen and see that the same field is displayed. The Entry/Marker knob can be used to modify the value in this field.

This feature saves you having to return to one of the menus when you want to see the effect on measurement results of changing one numeric parameter.

AN EXERCISE

This exercise demonstrates the ability of the HP 5372A to configure itself to make particular measurements. This exercise shows why you should use the **Preset** key before each new measurement setup.

This is a quick look at a special-purpose measurement:

1. Press the **Preset** key.
2. Select a Rise Time measurement. The Function menu should look like the screen in *Figure 2-14*.

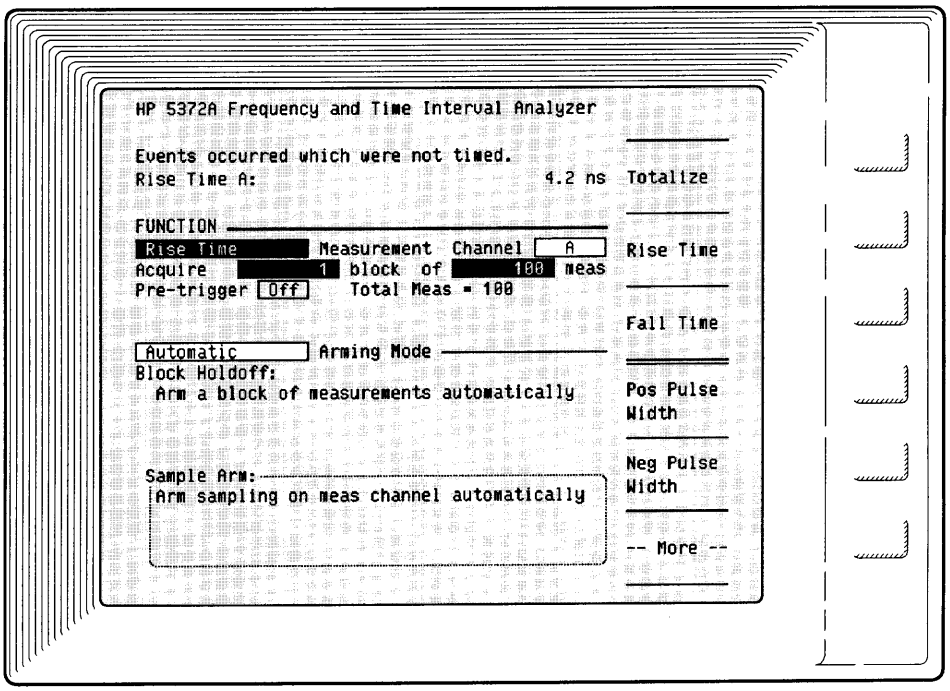
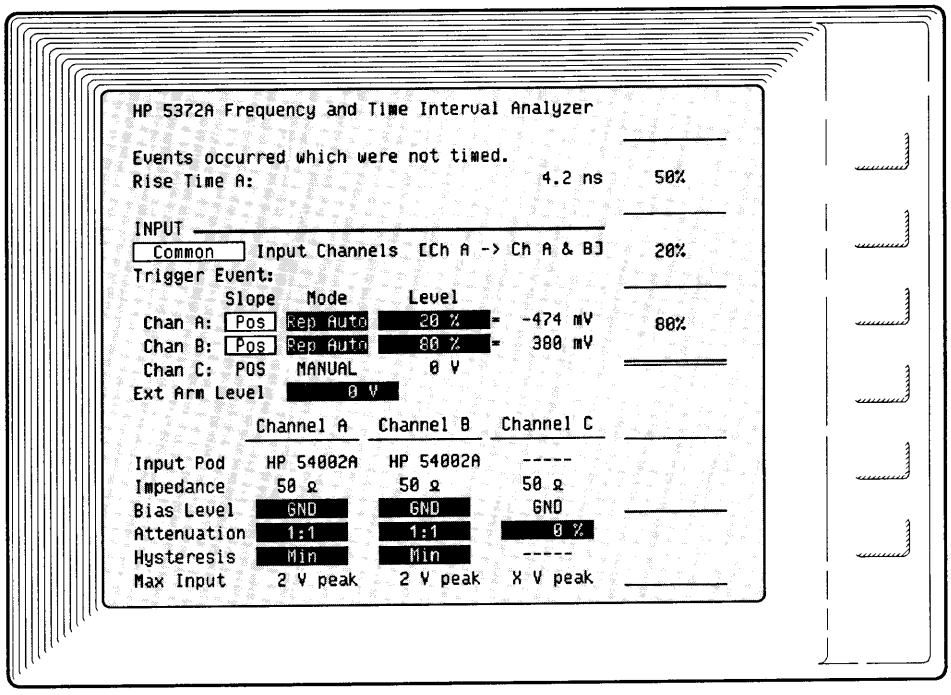


Figure 2-14. Rise Time Function Menu

Notice how the Function menu is changed. It shows examples of "restricted fields" on the HP 5372A. Restricted fields enclose menu parameters that cannot be changed. The signal to be measured can only be input to Channel A and the arming mode is Automatic. Try moving the menu cursor to these fields.The cursor "jumps" over them. They cannot be altered.

3. Go to the Input menu. It should look like *Figure 2-15*.

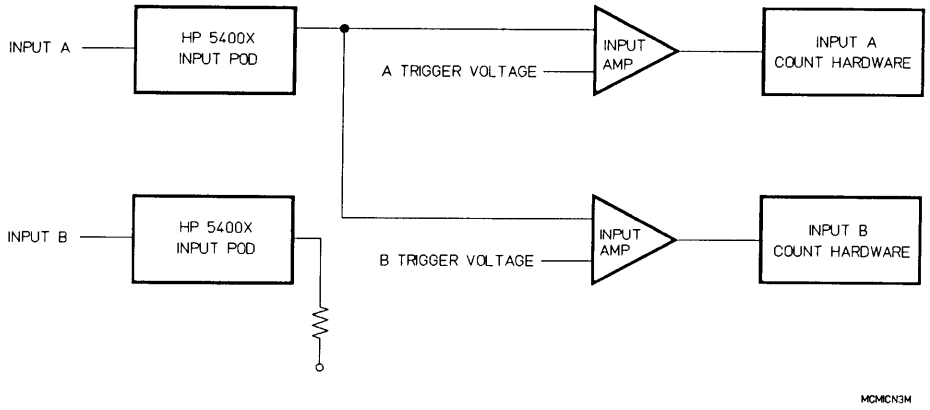
Figure 2-15. Rise Time Input Menu

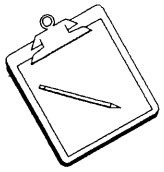


Here you can see that several more fields are "locked out." The field at the top indicates the setting for the input channels. Channel A and B are set to Common. The trigger event slope is set to Positive for both Channel A and B. The trigger event level is set to 20% for A and 80% for B.

Notice also that the LED at the Channel B input pod is flashing.These lights only flash when a signal is being sensed properly by the input circuitry. For a Rise Time measurement, the signal at the Channel A input is also routed to the Channel B input circuitry. This is called "Common Mode." The Rise Time measurement is an example of where the two input channels are to trigger at different points on the same slope of the same signal. *Figure 2-16* shows the input configuration.

Figure 2-16. Common Mode Input Configuration





TECHNICAL COMMENT

Rise Time is an example of a special-purpose measurement for the HP 5372A where a set of assumptions are made about the signal you want to measure. The instrument is configured to a simple setup to make a specific measurement. If these settings are too limiting, other measurements could be substituted, providing more options.

For example, a rise time measurement could be made with the following setup:

- *±Time Interval A → B*
- *Input Channels set to Common*

This configuration provides a wide variety of arming modes.

4. Go to the Function menu and select a Frequency measurement.

Something to realize when leaving a special- purpose measurement such as Rise Time is that not all instrument parameters are returned to their original settings. For example, return to the Input menu and note that:

- Input channels are still in Common (indicated on the front panel by the flashing LED at Channel B)
- Trigger event levels are still set to 20% and 80%

There are instances where this operation could cause confusion. To avoid this confusion, you should always use the **Preset** key to return the 5372A to a known condition before selecting a new measurement.

5. Press the **Preset** key to return the Analyzer to its default settings.

A MEASUREMENT SETUP GUIDE

Setting up the HP 5372A to make a measurement consists of four steps. After a quick preview here, in the next chapter you will go through each step as you set the HP 5372A to measure a signal you provide.

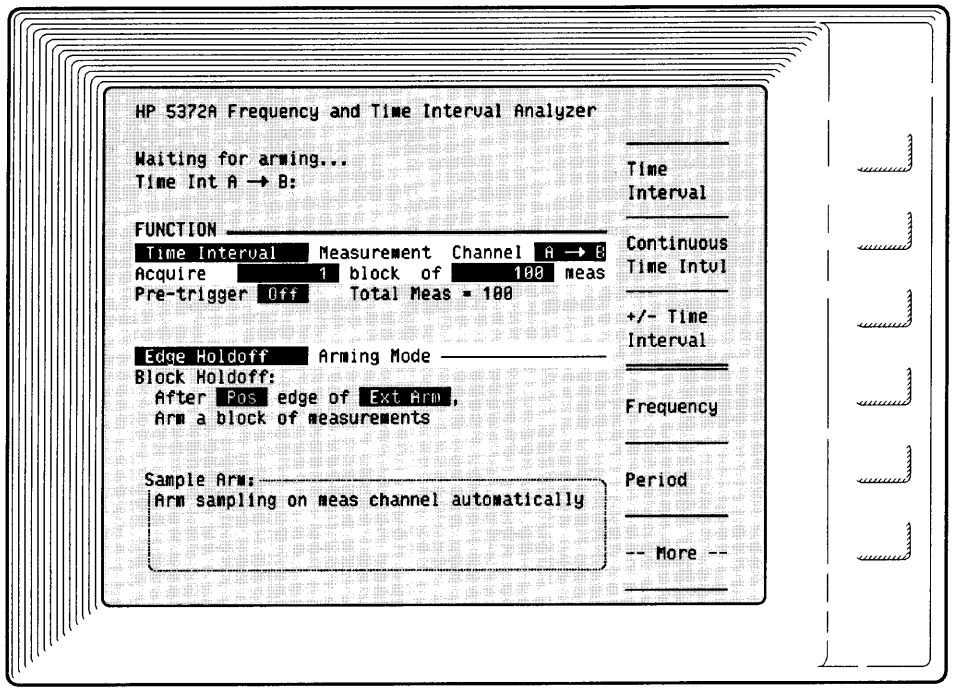


Figure 2-17. Function Menu

Figures 2-17 and *2-19* show the screens as set in these steps.

The four main setup steps are:

Step One Select the measurement function on the Function menu.

An example of a measurement function is: Time Interval A →B

Step Two Specify the number of measurements on the Function menu.

An example of a number of measurements is: 1 block of 100 measurements

Step Three Select an arming mode on the Function menu.

An example of an arming mode is: Edge Holdoff

As shown in *Figure 2-18,* this arming mode delays the start of the measurement until after an edge of the signal at the External Arm Input.

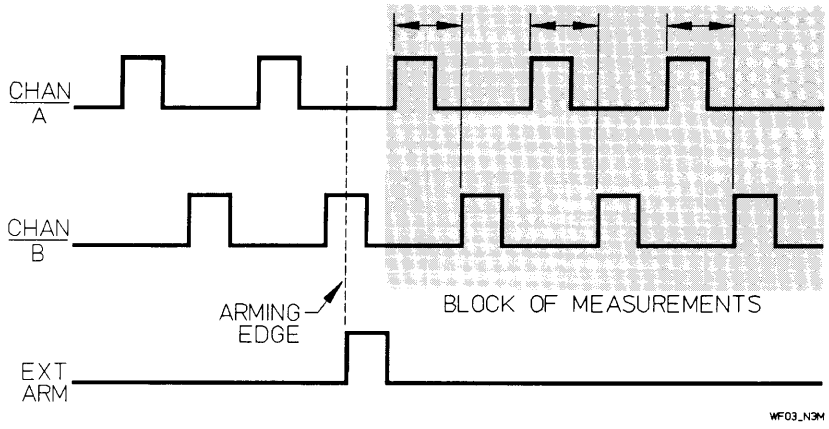
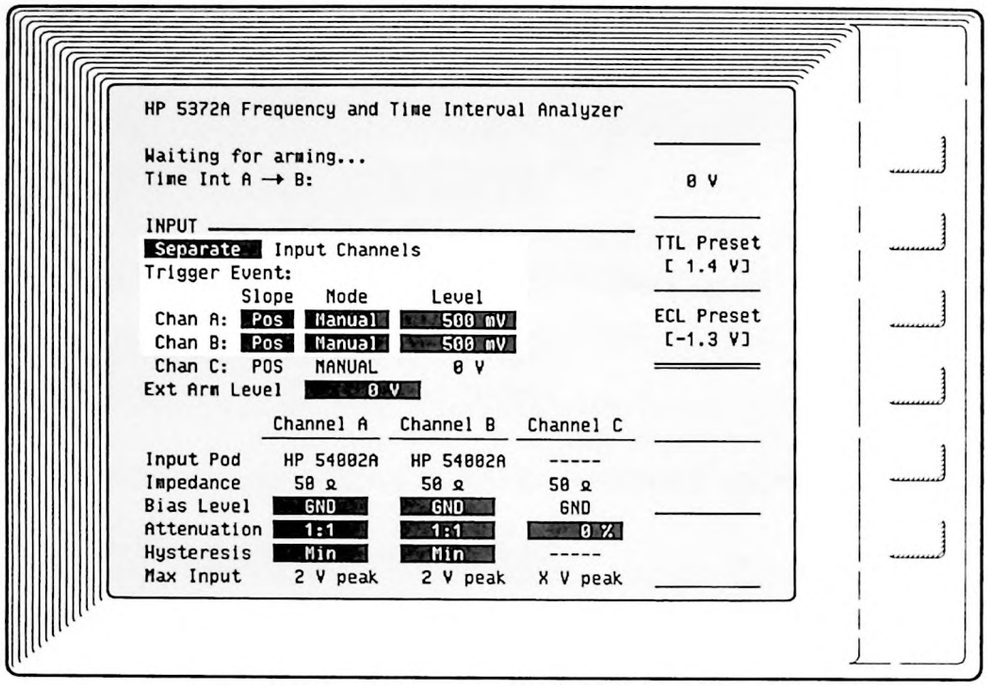


Figure 2-18. Edge Holdoff Arming Mode

Step Four Specify the trigger event condition on the Input menu.

An example of a trigger event condition is: separate input channels, positive slope on both channels A and B, manual mode, 0.5 V on both A and B

Figure 2-19.
Input Menu



PRE-TRIGGER

This feature allows the HP 5372A to capture measurement data that occurs before some event or interval that you specify. If you want to use the Pre-trigger feature for a measurement, another step would be needed to set the Pre-trigger menu. There is an example using Pre-trigger in chapter 5 of this guide. Refer to, "Pre-trigger Menu," chapter 10 of *Operating Manual* for more information.

CHAPTER 2 SUMMARY

Chapter 2 introduced you to operating the HP 5372A with the following:

- What you can expect when you power-up the HP 5372A
- The three-step process for changing menu parameters
- An introduction to the parameters on the Function and Input menus and how they affect the measurement
- Making a Time Interval and a Frequency measurement and displaying the results
- Changing the arming mode and the time over which measurement data is collected
- A four-step guide for setting up measurements

CHAPTER 3 PREVIEW

Chapter 3 provides more details about measurement setup and analysis by having you make measurements on a signal you provide. The graphics capabilities of the HP 5372A are introduced to analyze your measurement results.

3

MAKING CONTINUOUS FREQUENCY MEASUREMENTS

CHAPTER OVERVIEW

This chapter demonstrates the analysis features available with the HP 5372A. The measurement is on a signal with frequency modulation (FM).

This chapter describes:

- Step-by-step process for setting up the measurement
- A review of the results using the graphics capabilities
- A demonstration of how to modify the measurement setup to capture the data of interest
- Graph features

SIGNAL TO BE MEASURED

Set a signal source to generate a signal with the following characteristics:

- Frequency of carrier — 10 MHz
- Amplitude — 100 mV
- Modulation Rate — 10 kHz
- Peak-Peak deviation — 100 kHz

MEASUREMENT SETUP STEP-BY-STEP

Follow the steps below and perform the actions as requested.

Step One

Select the measurement function.

1. Press the **Preset** key and select **Frequency** from the softkey choices.
2. Move the menu cursor to the **Channel** field.

Channel A is selected by the Preset feature. No change is needed.

Step Two

Specify the number of measurements.

1. Move the menu cursor down to the **block** field.

A block size of "1" is selected by the Preset feature. No change is needed.

A block is one or more measurements collected in a group. When you want to change the number of blocks, use the DATA ENTRY keypad to enter numbers and the **Enter** key to conclude the operation. For this example, use the default setting of 1 block. *Figure 3-1* shows a block of measurements.

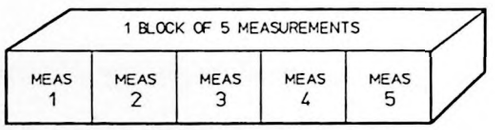


Figure 3-1. Block of Measurements

2. Move the menu cursor over to the **meas** field.

A measurement size of "100" is selected by the Preset feature. No change is needed.

The value in this field sets the number of measurements in each block.

It is a good idea to limit the size of your measurement until you have arrived at the optimum arming setup for your particular measurement.

TECHNICAL COMMENT

Some advantages of using a small measurement size are:

- *faster update of results display*

You can then modify the parameters and measure again. Repeat until you have the appropriate measurement setup for your application.

- *analysis of results is easier*

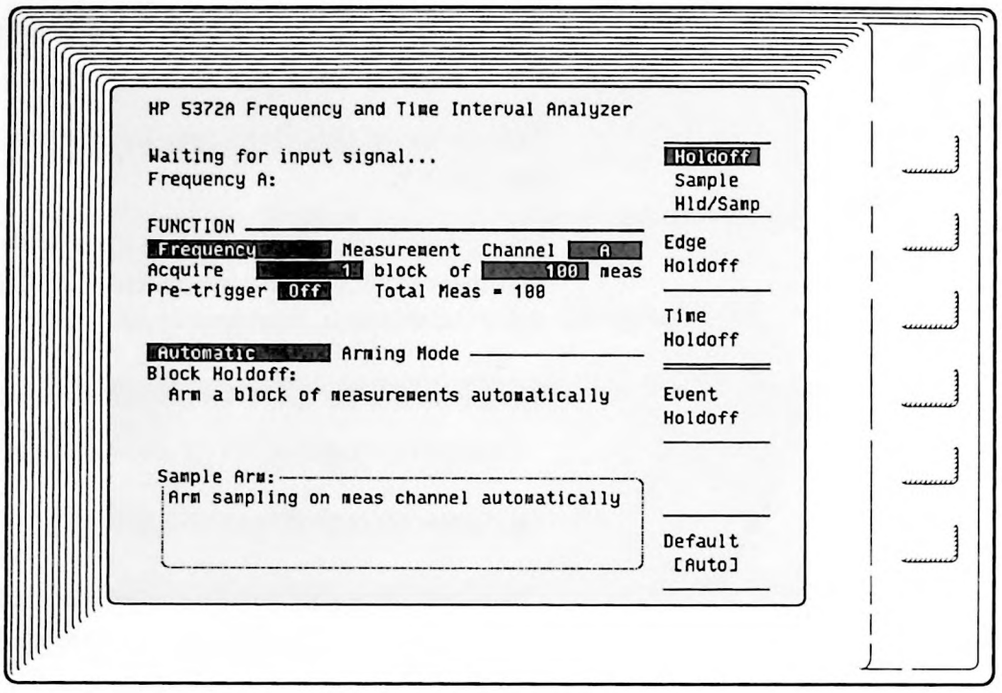
You will have to do less zooming and marker movement on the graphs to view the data of interest.

Step Three Select an arming mode.

1. Move the menu cursor down to the **Arming Mode** field.
2. You will not change the arming mode now, but press the top softkey several times to see some of the different arming modes available for this type of measurement.

At this point, the Function menu should look like *Figure* 3-2.

Figure 3-2.
Function Menu

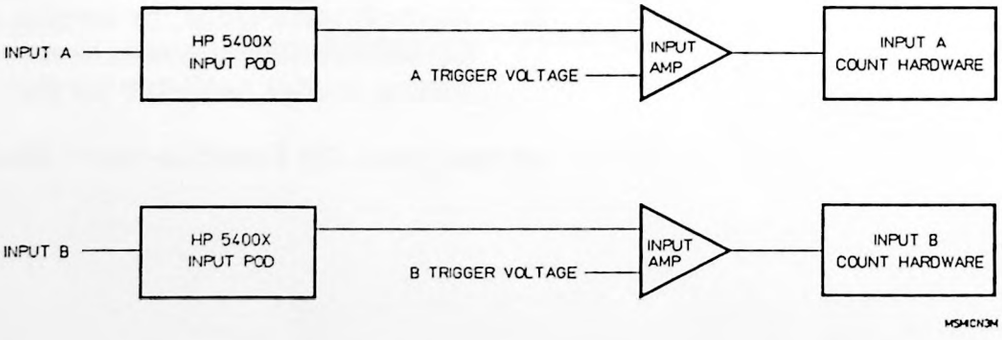


Step Four

Specify the trigger condition.

1. Press the **Input** key.
2. Verify that the **Input Channels** field is set to **Separate**. This makes the input channels independent of one another as shown in *Figure 3-3*.

Figure 3-3.
Separate Mode Input Configuration

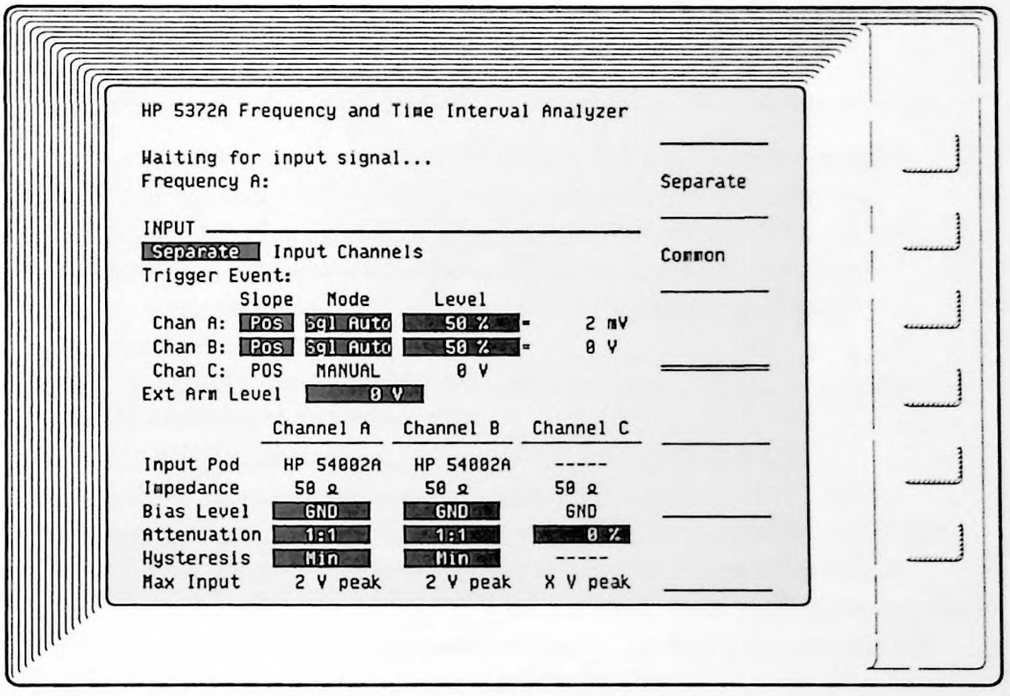


3. The default Trigger Event settings (**Slope, Mode, Level**) for Channel A are acceptable for this measurement.

The Slope is set to positive, so it is the rising edge of the signal at Channel A that will trigger the input circuitry. The Mode is set to Single Auto Trigger, and the Level is at 50%. This means that the voltage level of the input signal that will trigger the input circuitry will be automatically selected at the mid-point of the signal's peak-to-peak voltage value.

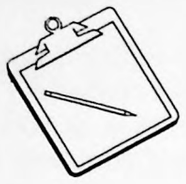
At this point, the Input menu should look like *Figure 3-4*.

Figure 3-4. Input Menu



4. Move the menu cursor to the Channel A **Mode** field. The softkey options are: **Manual Trigger, Single Auto Trigger**, and **Repetitive Auto Trigger**. For now, it is enough to know that the trigger level voltage point is being automatically set. The HP 5372A determines the peak-peak values of the input signal and then sets the actual trigger voltage accordingly.

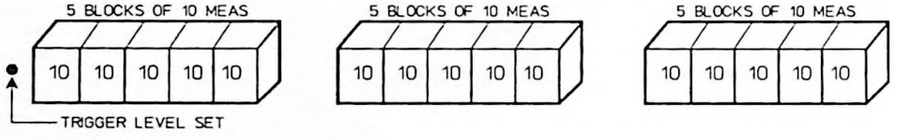
TECHNICAL COMMENT



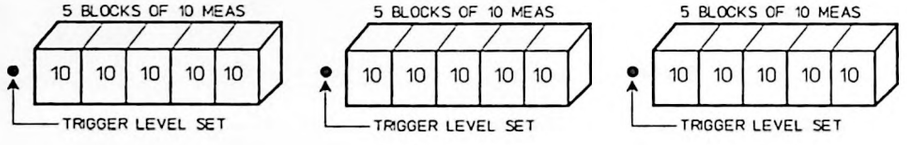
The Auto Trigger modes operate from 1 kHz to 200 MHz. Use the Manual Trigger mode if your signal is outside this range. Also, the Auto Trigger modes delay the start of your measurement because data cannot be collected until peak amplitude levels are determined and the trigger voltage is set. And finally, if you are making a single-shot measurement, use the Manual Trigger mode because Auto Trigger requires a repetitive signal.

The difference between the two Auto Trigger modes (with the **Single/Repet** *front-panel key set to* **Repet***):*

- *Single Auto Trigger sets the trigger level only when the measurement sequence executes for the first time.*



- *Repetitive Auto Trigger sets the trigger level each time the measurement sequence repeats.*



When using the Auto Trigger modes, enter a percentage of full scale according to where on the input signal you want to trigger. For the Manual Trigger mode, enter the specific voltage of the desired trigger point.You can find the positive and negative peak values of your input signal using the Peak Amplitude measurement function.

MEASUREMENT AND ANALYSIS

These procedures will have you connect the signal to the HP 5372A, review numeric and graphic results, change arming mode, arming conditions, and exercise some of the graphics features.

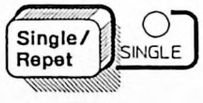
Start Measuring

1. Connect the 10 MHz frequency modulated signal to the Channel A Input.
2. Notice that the Channel A LED and the Gate LED are flashing. The HP 5372A is now repeatedly executing the measurement sequence defined on the Function menu. Data is being collected for 100 measurements, results are calculated and displayed. Then the process starts over immediately.

TECHNICAL COMMENT

One of the advantages of the HP 5372A is that the measurement data is captured continuously within a block of measurements, with no result processing between measurements. In this example, the data for 100 measurements is captured without stopping. This is very valuable as it allows frequency profiling of your input signals.

Select Single Acquisition Mode



The HP 5372A is currently operating in what is called, "repetitive acquisition mode." It is a "free-run" condition where the instrument collects data, calculates results, displays results, and then restarts the measurement sequence. New measurement data is written over the old. You will now set the HP 5372A to "single acquisition mode" to have it execute the measurement sequence once, and then stop.

1. Press the **Single/Repet** key (near the Gate LED).
2. Verify that the LED beside the **Single/Repet** key turns on. This indicates that the HP 5372A is in the single acquisition mode.
3. Press the **Restart** key to repeat the measurement sequence. One sequence is executed each time the key is pressed.

Review the Results

Here you will see a listing of the measurement results.

1. Press the **Numeric** key.
2. Press the top softkey to select **Main**.
3. Press the **Expand** softkey to set this feature to On.

Now you can see the sampling interval below each measurement result.

4. Press the **Set** softkey and select **Meas #**. Then use the knob to scroll through the results.

There is very little variation in the results. This is because the 100 measurements were collected over such a short time. The measurement sequence took approximately 10 μs, much shorter than the period of the 10 kHz modulation signal (100 μs).

The steps to come show you more graphically what this means and what to change so you can collect more valuable information about your input signal.

Analyze the Results

It is difficult to make sense of your measurement data from just a long list of numeric results. The following steps will show how the HP 5372A helps you interpret your data with graphics.

1. Press the **Graphic** key.

The graph features are presented using a combination of single and multiple softkey options. Where a softkey offers more than one option, the active option is shown in inverse video. Pressing the softkey will cause the next option to become active.

2. Display the Time Variation graph by selecting the **Time Var** feature with the softkey second from the top. You should see a display similar to *Figure 3-5*.

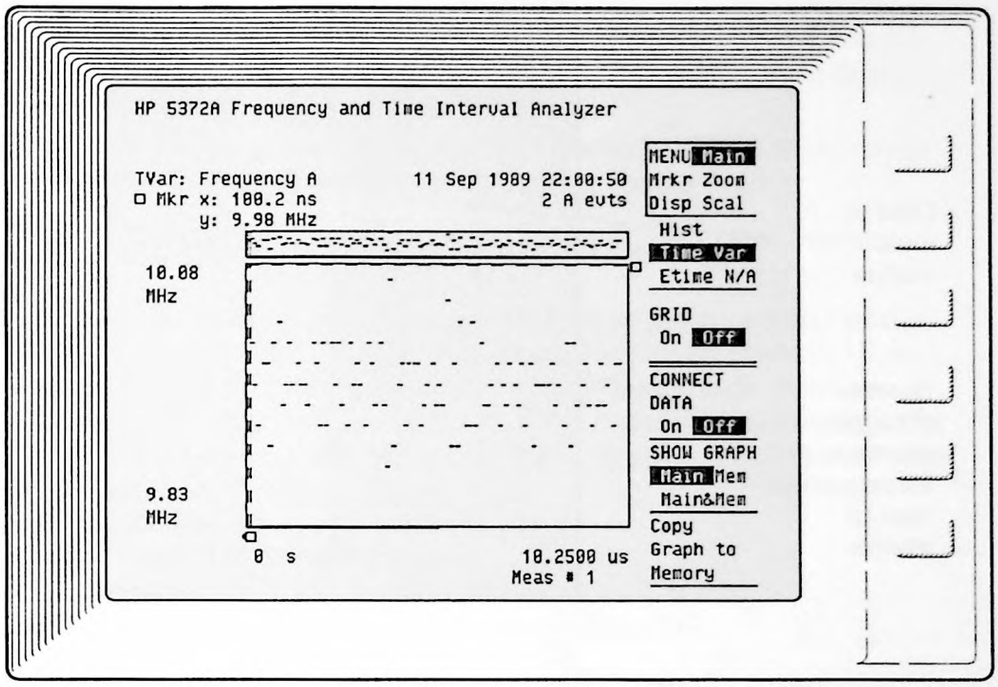


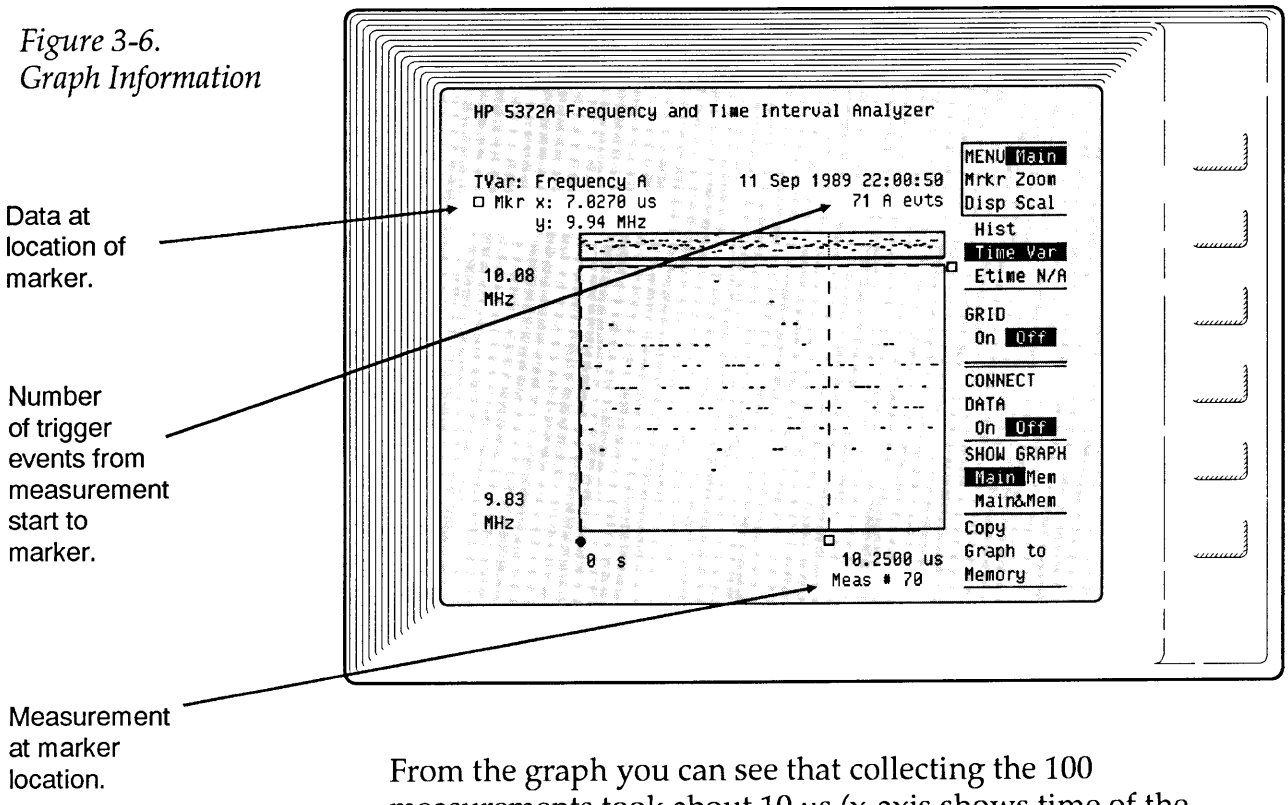
Figure 3-5. Time Variation Graph for Measurement Results

The Time Variation graph plots the measured values over the time of the measurement sequence. It shows the variation in frequency during the time of the measurement sequence, or Frequency vs. Time. The y-axis shows the range of the measurement results, in this case, frequency results; the x-axis displays the elapsed time of the measurement sequence.

3. Move a marker across the graph by rotating the Entry/Marker knob.

Note the information on the screen. At the top of the graph are the x- and y-axis values at the position of the active marker. There are four markers for use on the graphs (2 vertical, 2 horizontal). The active marker is the one currently under the control of the knob. You can also see the number of trigger events that have occurred from the start of the measurement to the position of the marker. At the bottom of the display is the number of the measurement at the position of the marker. These items are highlighted in *Figure 3-6*.

Figure 3-6.
Graph Information



From the graph you can see that collecting the 100 measurements took about 10 μs (x-axis shows time of the measurement sequence). Your signal is being modulated at a rate of 10 kHz (a period of 100 μs). The Automatic arming mode does not provide a long enough sampling interval (100 ns) for the measurement sequence. Not enough of the signal is captured to show a complete modulation cycle.

The solution is to use an arming mode that lets you control the interval over which frequency measurements are taken. Automatic arming collects data as quickly as possible. If you collect the 100 measurements over a longer period of time, more of the variation in the signal will be displayed.

Modify Sampling Interval of Data

The following steps demonstrate how to change the time over which measurements are acquired.

1. Press the **Function** key.
2. Press the top softkey to select **Sample**. (First make sure the menu cursor is at the **Arming Mode** field.)
3. Press the **Interval Sampling** softkey.

A new measurement sequence begins as soon as you change the arming mode. The default value for the interval is 10 µs. This means that each measurement will be made over an interval of approximately 10 µs. One hundred measurements will be made in 1 ms. Now check the graphic results with the next step.

4. Press the **Graphic** key.

The graph will look like the one in *Figure 3-7*.

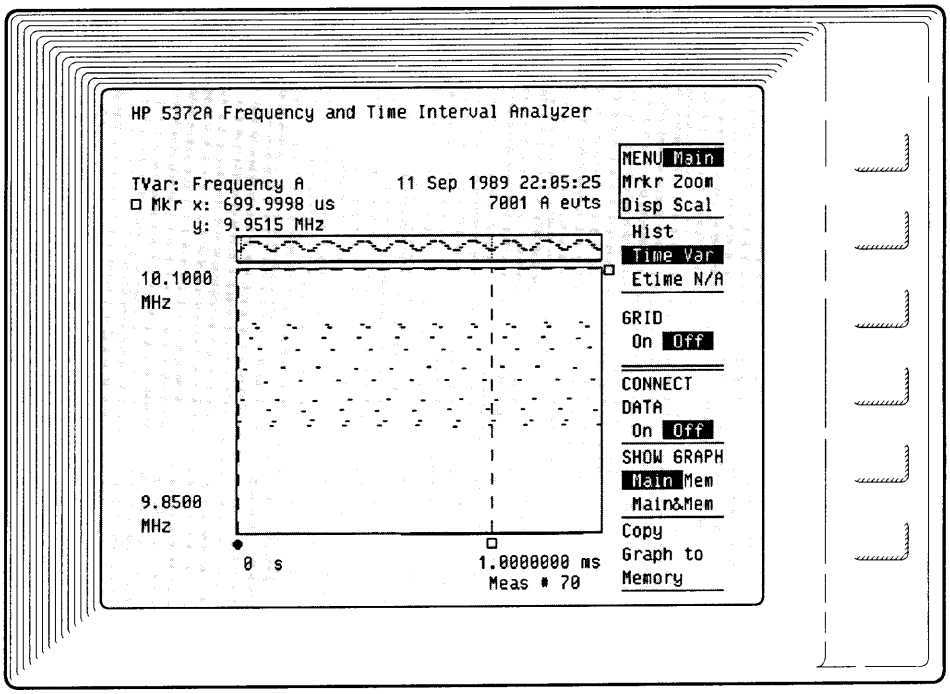


Figure 3-7. Frequency with Modulation

Now you are seeing the modulation on the signal. The next step will have you enter a new interval value so you can see the modulation information more clearly.

5. Press the **Function** key.
6. Move the menu cursor to the **intervals** field.
7. Enter "4" in the **intervals** field using the Data Entry keypad.
8. Press the **us** softkey to complete the new value entry.

The acquisition time for the block of 100 measurements is now 400 µs, as shown at the bottom of the Function menu. The next step takes you back to the Graphic screen to check the results.

9. Press the **Graphic** key. You should see a display similar to *Figure 3-8*.

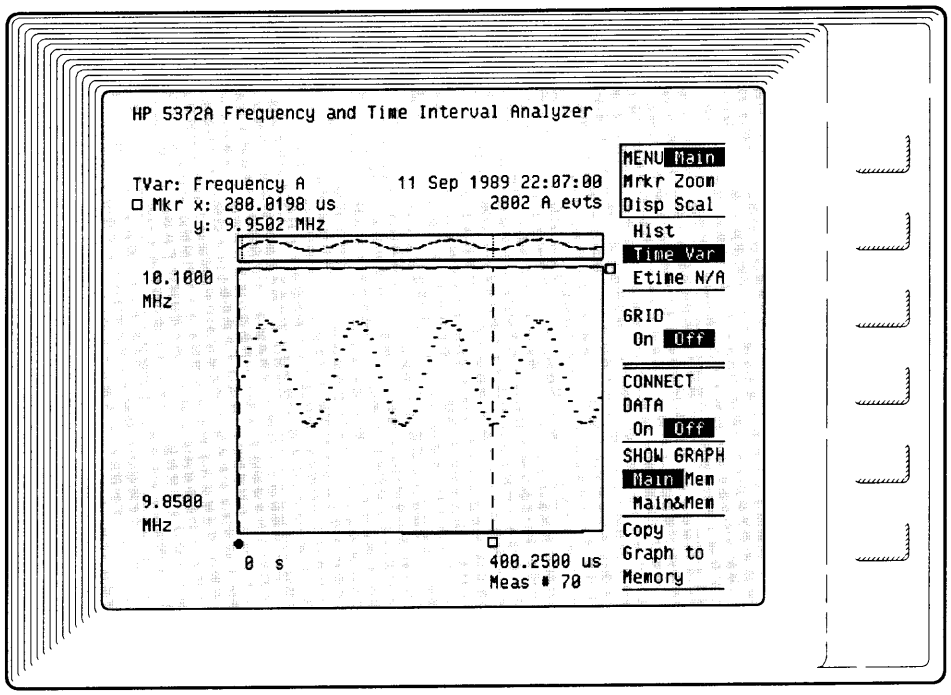


Figure 3-8. Frequency vs. Time

Something to realize is that although it looks like an oscilloscope display, you are not seeing voltage vs. time. The HP 5372A is displaying frequency vs. time. The frequency measurements vary over time according to the modulation.

Using Modulation Analysis

The following steps demonstrate a feature for analyzing the modulation on your signal.

1. Press the **MENU** softkey (top softkey) to select **Mrkr**. This displays the marker options.
2. Move the markers (↔□ ↔●) so that more than one period of the sine wave is between them.
3. Press the softkey labeled **Marker**, **Delta**, and **Mod Vals** until **Mod Vals** is selected. See *Figure 3-9*.

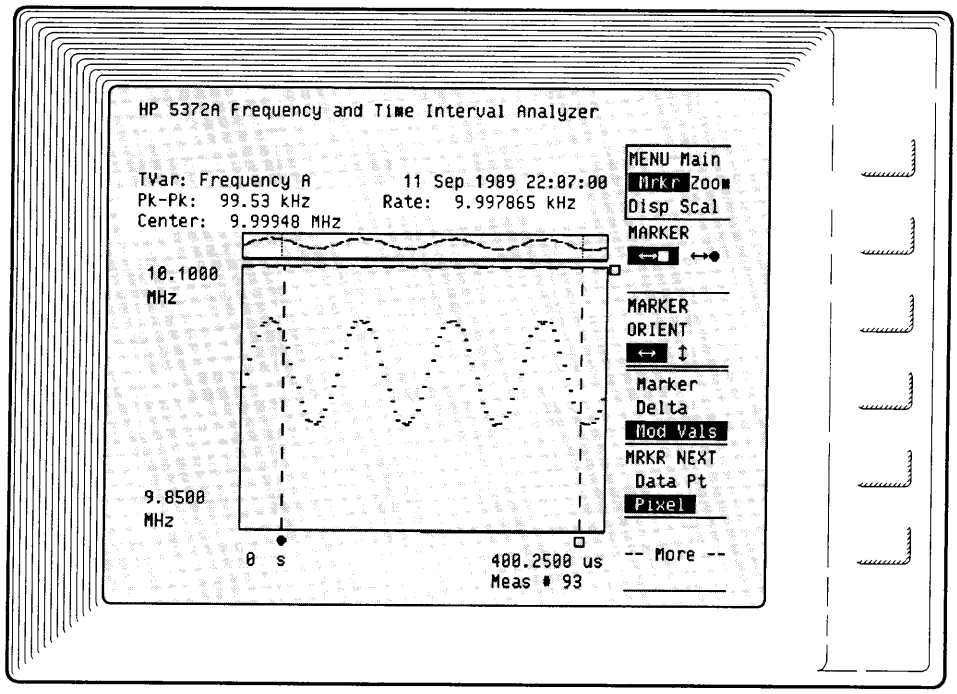


Figure 3-9. Modulation Analysis

The graph displays the peak-to-peak value, the center frequency, and the modulation rate for the data between the two markers.

More Graphics Features

The following steps demonstrate the zoom feature and how to scroll a graph.

1. Press the **MENU** softkey to select **Zoom**.

Now you have access to the Zoom features.

2. Move the active marker from one side of the display to the other. Notice the bright line at the bottom of the graph that moves with the marker. This line shows the portion of the displayed signal that will fill the screen when the **Zoom In** softkey is pressed.

3. Press the **Zoom In** softkey.

You are now viewing about half of the total captured signal. The bright line at the marker underlines what will fill the display area should you press the zoom softkey again.

Notice the smaller graph area above the main display area. This is called the "panorama graph." This area always displays all the acquired graph data. There is another bright line visible at the bottom of the panorama graph. It shows the portion of the captured signal that is currently displayed in the main graph area below.

4. While the graph is zoomed in, rotate the knob to move the marker to the edge of the main graph and continue rotating the knob so the graph starts scrolling. The panorama graph shows the marker movement with reference to all the graph data.

5. Zoom in and out to get a feel for the action of the zoom feature.

6. With the graph zoomed in, press the "<" and ">" Cursor/Scroll keys. This feature scrolls the graph over by the width of the display each time the key is pressed.This will become clear once you try it.

7. Press the **Return to Full Scale** softkey to have the main display area show all the acquired data once again.

Frequency Measurement Histogram

Another graph for viewing data with the HP 5372A is the Histogram graph.

1. Press the **MENU** softkey to select **Main**.
2. Select the Histogram graph by pressing the softkey second from the top to highlight **Hist**.

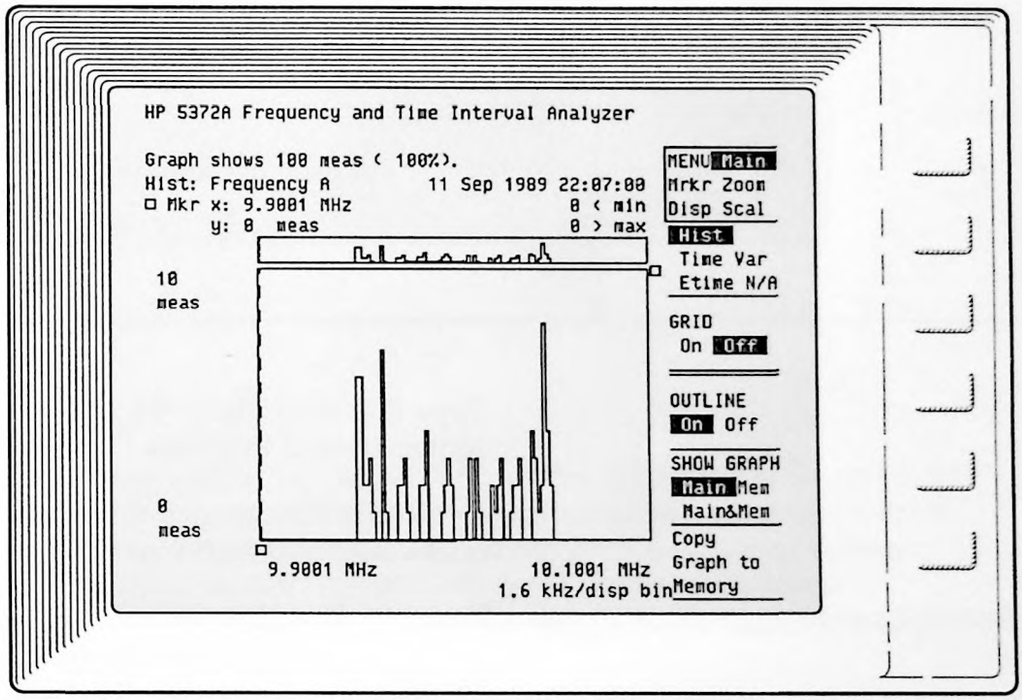


Figure 3-10. Histogram of 100 Measurements

A histogram of the one hundred measurements is displayed in *Figure 3-10*. This sample size is not large enough to show a valid distribution of the measurement results. The following steps will have you increase the number of measurements from 100 to 8,000.

3. Press the **Function** key.
4. Move the menu cursor to the **meas** field.

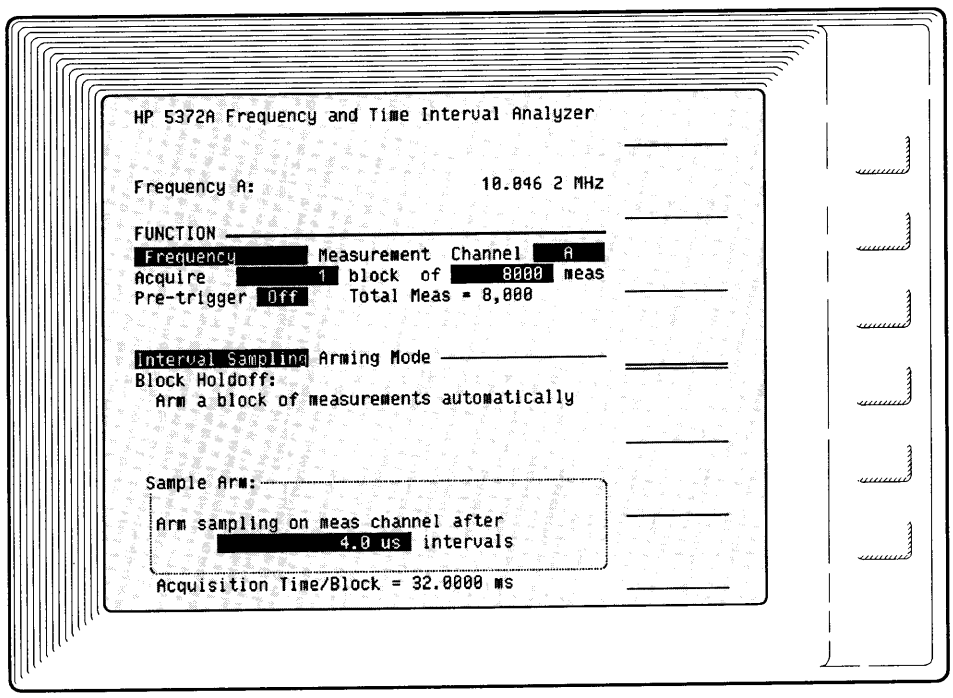


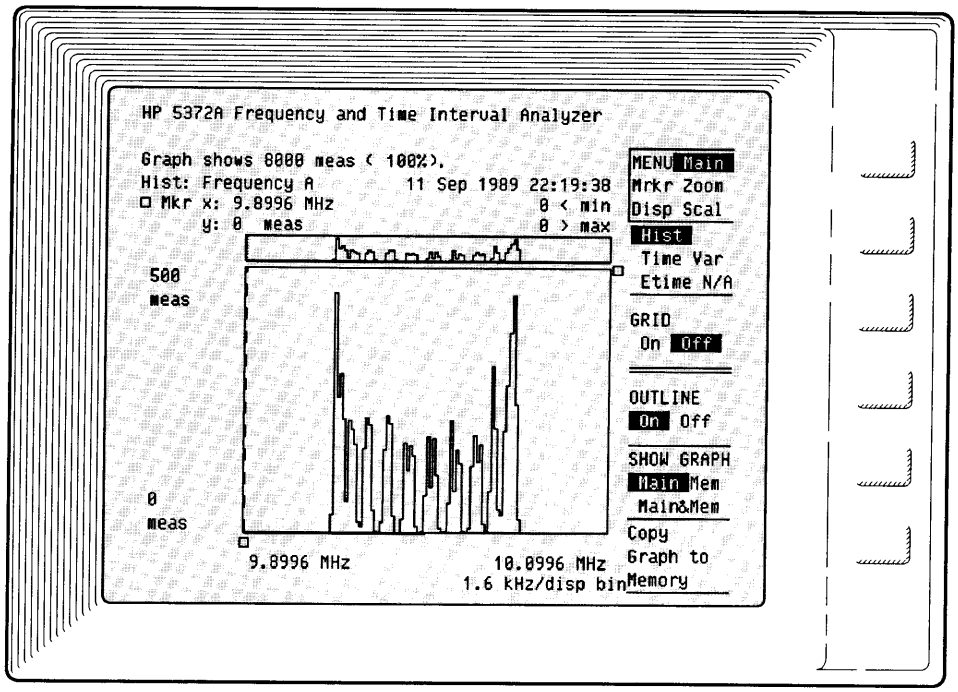
Figure 3-11. Function Menu Setup for 8,000 Measurements

5. Type 8000 into the field, and press the **ENTER** key. The screen should look like *Figure 3-11*.

The data collection, measurement calculations, and display of the results take about five seconds.

6. Press the **Graphic** key.

Figure 3-12. Histogram of 8,000 Measurements



The graph in *Figure 3-12* shows the distribution for the 8,000 frequency measurements. The y-axis shows the number of measurements, the x-axis the range of frequency values. Notice that the "saddle" shape of the distribution is characteristic of sine wave modulation, the type of modulation in this example.

CHAPTER 3 SUMMARY

Chapter 3 has shown you an example of measuring a signal with modulation. While demonstrating this, the following items were introduced:

- Step-by-step measurement setup
- The process of making a measurement
- Reviewing the numeric results
- Reviewing the graphic results and interpreting the data displayed
- Varying the sampling interval to view the signal appropriately

CHAPTER 4 PREVIEW

Chapter 4 demonstrates an HP 5372A feature for collecting large amounts of time interval data and sorting it into a histogram very quickly.

4

MAKING CONTINUOUS TIME INTERVAL MEASUREMENTS

CHAPTER OVERVIEW

This chapter introduces the Histogram measurement function of the HP 5372A. Histogram measurements are intended for situations where you need to acquire and analyze a large amount of data very quickly.

TECHNICAL COMMENT

Histogram measurements should not be confused with the Histogram graphs available for most measurements. There is a fundamental difference.

The Histogram graphs available for measurements other than Histogram measurements, are the result of software processing. No calculations or sorting of data takes place until the acquisition of all data is completed.This can take a sizable amount of time, even for a relatively small sample size (8,000 measurements).

For Histogram measurements, hardware processing is used by the HP 5372A to dramatically decrease measurement processing time. Sample sizes of 1,000,000 measurements, or more, can be acquired in a fraction of the time required for software-processed measurements. In order to achieve this speed of measurement and analysis, the only way to view the data graphically is with a histogram. The numeric results are presented as the number of measurements that were sorted into each histogram bin. (The next section shows an illustration of histogram bins.)

NOTE

You should perform the getting started exercises in chapters 1, 2, and 3 before starting this chapter. The following instructions for instrument setup presume a basic understanding of how to operate the HP 5372A as described in these previous chapters.

WHAT ARE HISTOGRAM MEASUREMENTS?

There are three Histogram measurements:

- Histogram Time Interval
- Histogram Continuous Time Interval
- Histogram ±Time Interval

Histogram measurements provide a display of a histogram distribution of the time interval measurement results. Histogram measurements sort data into the histogram bins at the measurement rate of the HP 5372A. The numeric data available (on the Numeric screen) consists of the histogram bin range values and the number of measurements that were sorted into each bin. *Figure 4-1* is a graphic illustration of how measurement results are sorted into histogram bins.

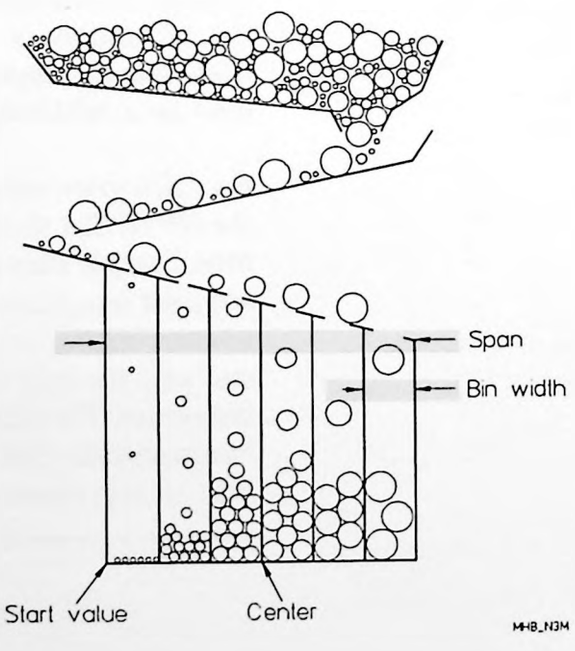


Figure 4-1. How Measurements are Sorted into Histogram Bins

Histogram measurements provide the following:

- Rapid acquisition of statistically significant sample sizes
- Access only to the histogram graph and the number of measurements in each histogram bin (the numerical range of each bin is displayed as well)
- Minimal post-processing time (the time between the last measurement and when the graph is displayed)

The rest of this chapter provides an exercise in making a Histogram measurement.

SIGNAL TO BE MEASURED

A signal similar to that in chapter 3 will be used for this demonstration. The signal characteristics are included here.

Set a signal source to generate a signal with the following characteristics:

1. Frequency: 10 MHz carrier with 10 kHz sine wave modulation.
2. Amplitude: 100 mV
3. Peak-Peak Deviation: 800 kHz

MEASUREMENT SETUP STEP-BY-STEP

Follow the steps below and perform the actions as requested. Where the instrument default conditions are appropriate for the measurement, that will be stated.

Step One

Select the measurement function.

1. Press the **Preset** key and select **Histogram Continuous TI** from the softkey choices. (You may need to press the **More** softkey several times.)
2. Move the menu cursor to the **Channel** field and select the **A** input channel for this measurement, if not already selected.

Step Two

Specify the number of measurements.

1. Move the menu cursor down to the **block** field.
2. Enter 1000 in the **block** field and press **Enter** key.

TECHNICAL COMMENT

Notice that a new field, Fast Arm, has appeared where the word "Acquire" was located. This field presents additional options whenever the number of blocks is greater than 1. The Fast Arm option minimizes the time between blocks of measurements. The other option for this field, Big Bin, should only be used when it is possible that the number of measurements in any one bin could exceed 16,777,199.That is the capacity of a bin. The Big Bin option increases the bin capacity with software processing. Data acquisition is slowed as a result.

3. Move the menu cursor over to the **meas** field.
4. Enter 1000 in the **meas** field and press **Enter** key.

The total number of measurements collected here is 1,000,000 (1000 × 1000).

Graph Limits For Histogram Measurements

Note that for Histogram measurements, the HP 5372A hardware must have the graph limits defined prior to acquisition. The limits are defined by the following values:

- Start
- Center
- Span
- Bin Width

The graphics display will indicate if measurements occur outside of these boundaries. Above the Histogram graph, for example, measurements falling out of range are listed as follows:

```
1310 <  min
  50 >  max
```

In this exercise, the default settings will capture all the data. This example also includes a method for determining what the settings should be when the default values are not adequate.

Step Three

Select an arming mode.

1. Move the menu cursor down to the **Arming Mode** field.
2. Use the default arming mode (Automatic).

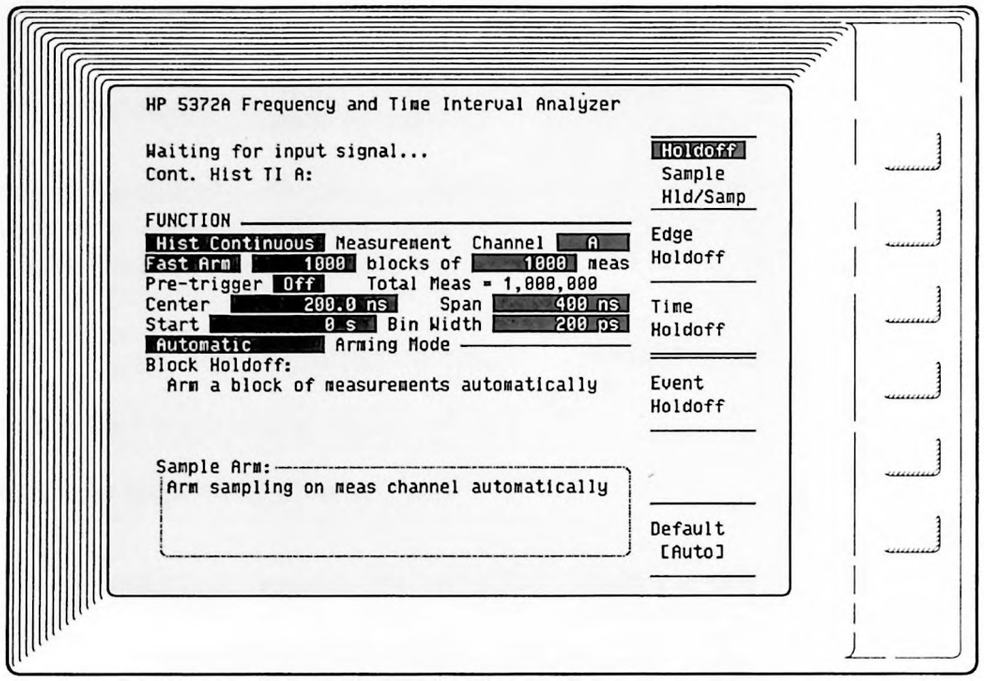
Step Four

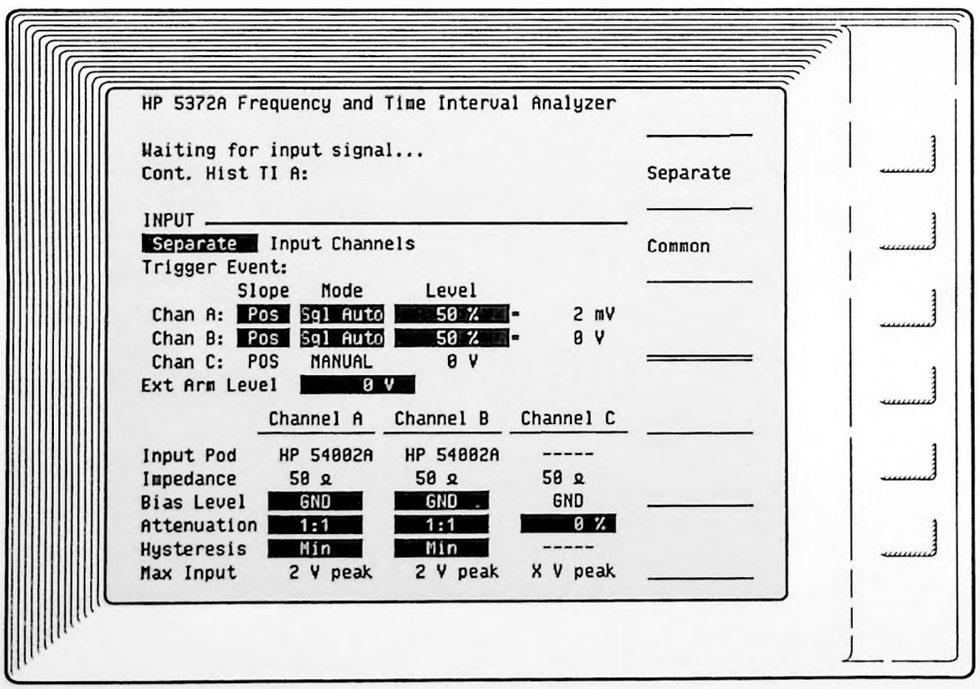
Specify the trigger condition.

1. Press the **Input** key.
2. Use the default settings.

Your Function and Input menus should be set as shown in *Figure 4-2*.

Figure 4-2. Histogram Continuous Time Interval Setup





START MEASURING

This procedure will have you connect the signal, review numeric and graphic results, change arming mode, arming conditions, and exercise some of the graphics features.

1. Connect the signal to the Channel A input.

2. Notice that the Channel A LED and the Gate LED are flashing. The HP 5372A is now repeatedly executing the measurement sequence defined on the Function menu. Data is being collected for 1,000,000 measurements, results are calculated and displayed.Then the process starts over immediately.

Review the Results

1. Press the **Graphic** key.

2. Press the **Single/Repet** key to place the HP 5372A into single acquisition mode.

Displayed is a histogram of one million Continuous Time Interval measurements as shown in *Figure 4-3*.

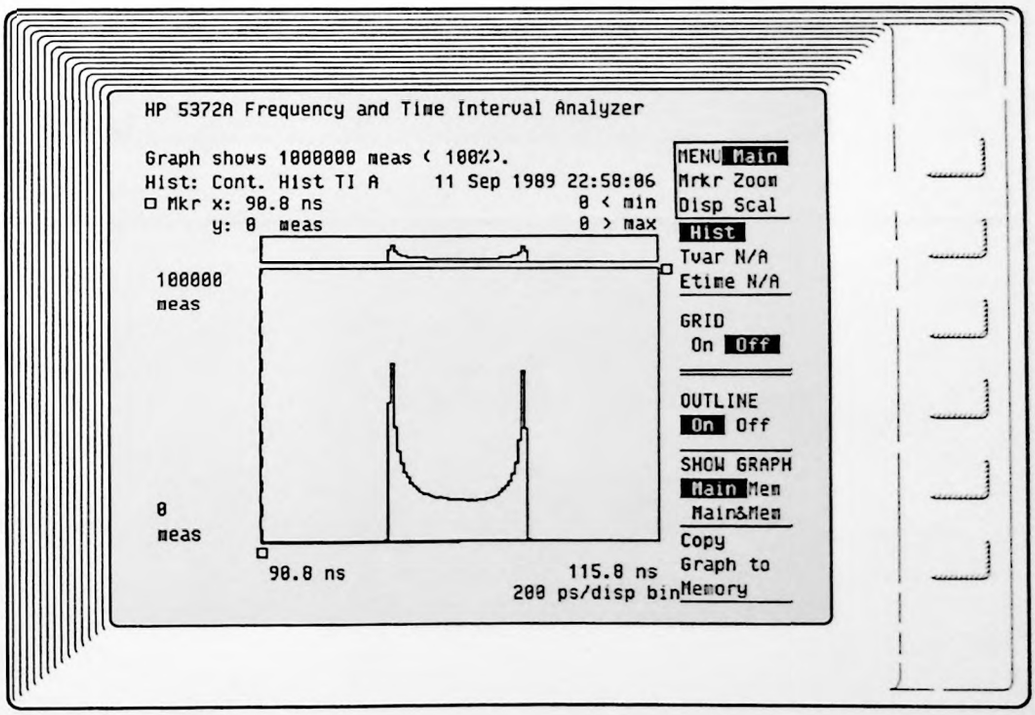


Figure 4-3. Histogram Measurement Results

Statistics on Your Histogram

1. Select the **Mrkr** menu with the top softkey.
2. With (↔□ ↔●) markers selected, set the marker function to **Stats**.
3. Position the markers so that there is one on each side of the histogram.

NOTE

The Preset function (executed at the beginning of this exercise) sets both markers to the extreme left side of the graph display. Rotate the Entry/Marker knob clockwise to move one marker to the right side of the display.

4. Verify that the status line (at top of display) shows, "Stats: 1000000 meas between markers".

The following statistics are displayed for the one million measurements:

- Minimum
- Maximum
- Mean
- Standard Deviation

The display should look similar to *Figure 4-4.*

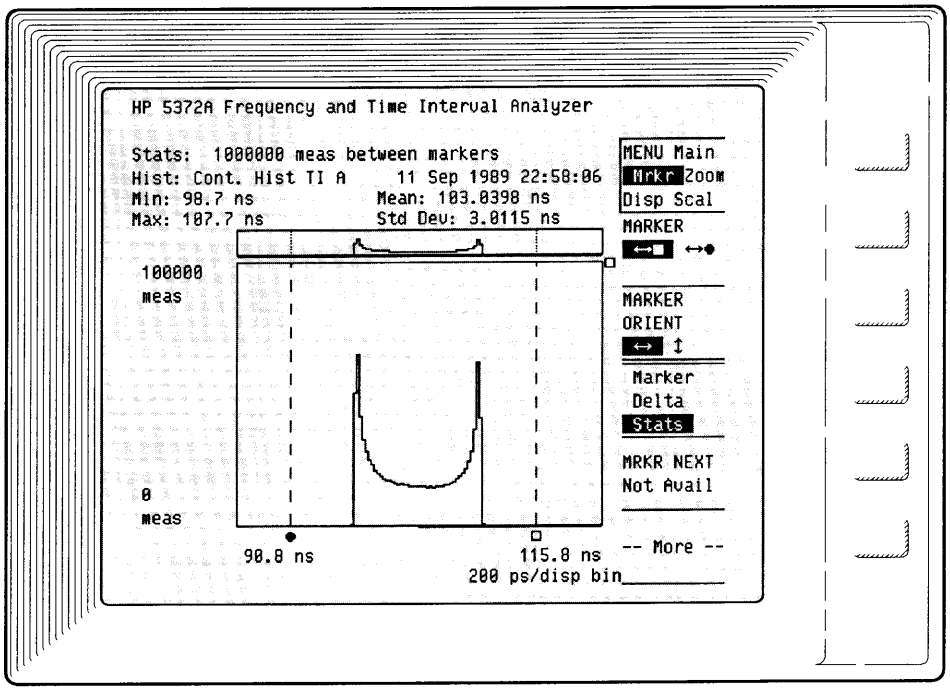
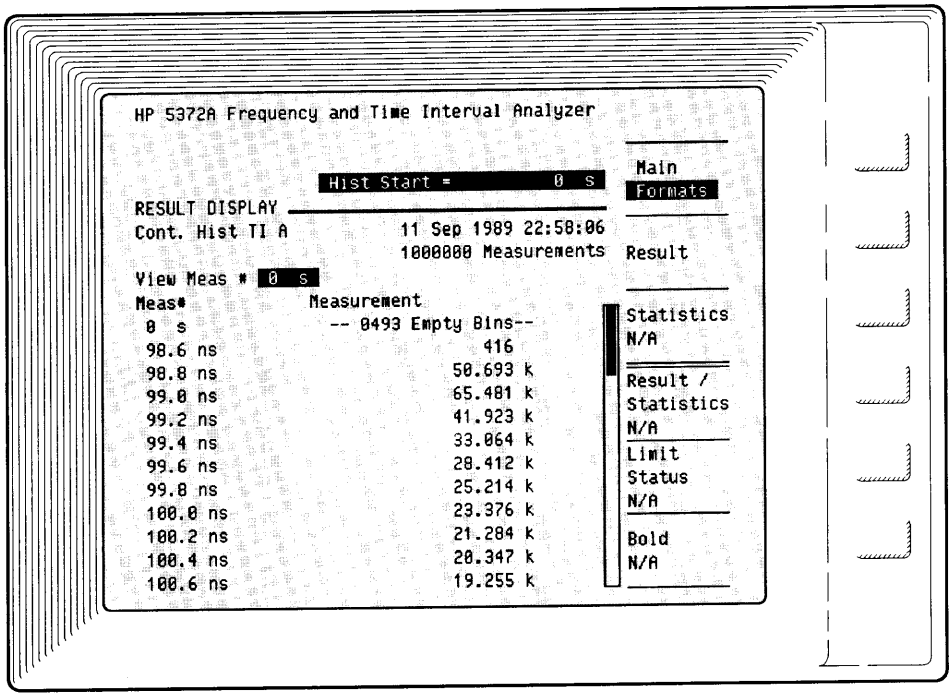


Figure 4-4. Histogram Continuous Time Interval Statistics

Numeric Results for Your Histogram

Results consist of time values for bins and the number of measurements sorted into each bin. The size of the bin is set on the Function menu in the **Bin Width** field. As you can see in *Figure 4-5*, each bin is 200 ps wide (same as set on the Function menu).

Figure 4-5. Histogram Numeric Results



HOW TO DETERMINE HISTOGRAM GRAPH LIMITS

This is an example of what to do when you want to make a Histogram Measurement, but you do not know where to set scale values for the Histogram graph.

1. Before continuing, go to the Graphic screen and set the **Mrkr** menu function to **Marker**. (The choices are: Marker, Delta, or Stats.)
2. Press the **Function** key.
3. Move the menu cursor to the **Start** field.
4. Enter "200 ns" as the start value.

5. Press the **Graphic** key.

There is no data on the display because all the data is outside the current boundaries of the graph. Look at the min/max labels at the top of the graph.They show that 1,000,000 measurements occurred outside the minimum value of the graph. See *Figure 4-6*.

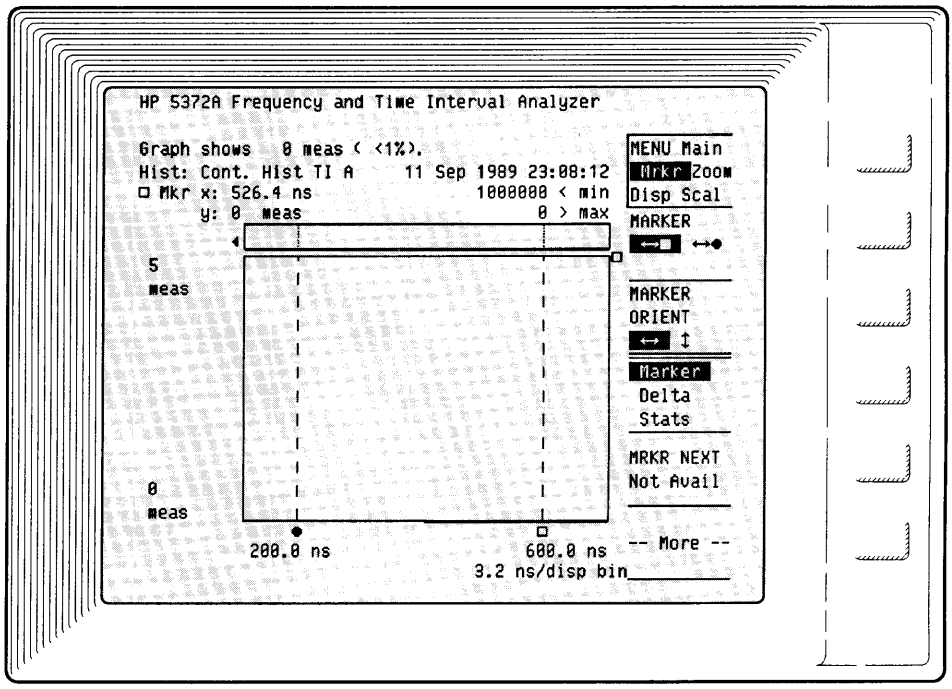


Figure 4-6. Example of Incorrectly Set Graph Limits

If you cannot predict the numerical range of your measurements, use one of the non-Histogram measurement time interval functions to find out where the results are located. Once you know, just return to the Histogram measurement and set the Start value below the minimum measured value. This is demonstrated here.

6. Press the **Function** key.

7. Move the menu cursor up to the **Measurement** field.

8. Press the **More** softkey once.

9. Press the **Continuous Time Intvl** softkey.

The HP 5372A is now making measurements in blocks of 1,000 measurements. The result displayed on the Function menu is the first measurement of each block. Each time the result changes, 1,000 more measurements have been collected. As you can now appreciate, this mode of time interval measurement is collecting data much more slowly than the Histogram function.

10. Press the **Graphic** key.

This Histogram graph is being calculated in software and has an Autoscale feature.The results are varying from about 90 ns to 115 ns in this example. This is all you need to know.

11. Press the **Function** key.

12. Press the **More** softkey until the **Histogram Continuous TI** softkey is displayed, then select it.

13. Move the menu cursor down to the **Start** field and enter a value less than 90 ns, say 50 ns.

14. Press the **Graphic** key, and see the results. The graph should look as it did before the start value was changed.

CHAPTER 4 SUMMARY

Chapter 4 introduced you to one of the more powerful features of the HP 5372A. The Histogram measurements help you analyze large amounts of data very quickly.

This chapter also described:

- A Continuous Time Interval measurement setup
- How to use statistics with histograms
- A way of determining where to set Histogram measurement graph limits for your measurements

CHAPTER 5 PREVIEW

Chapter 5 summarizes a VCO (voltage controlled oscillator) measurement application for the HP 5372A. Read this chapter for ideas on how the HP 5372A can help solve your VCO measurement needs.

5

VCO STEP RESPONSE EXAMPLE

CHAPTER OVERVIEW

This chapter describes some of the features and capabilities of the HP 5372A as applied to VCO (voltage controlled oscillator) measurements. The chapter is not intended to be a step-by-step procedure to making all VCO measurements, but rather it is a guide to making one type of VCO measurement.

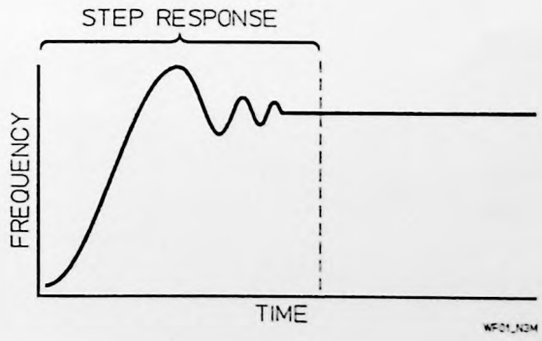
This chapter describes the following topics:

- A VCO signal
- How the HP 5372A could be set to measure the signal
- What could be learned from the measurement results

THE VCO SIGNAL TO BE MEASURED

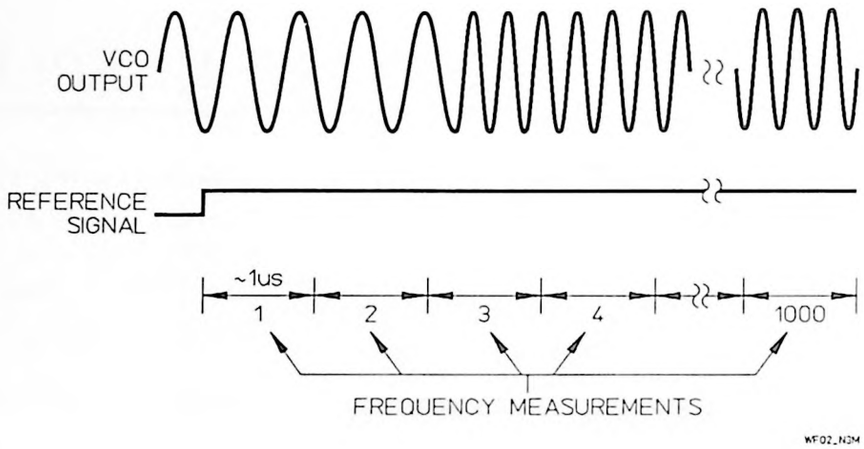
The Step Response of a VCO is a measure of how the output frequency changes when the input voltage is stepped from one voltage level to another. The HP 5372A lets you see this signal from a new perspective, a direct display of frequency as it changes over the time of the measurement. The HP 5372A can capture the step response of a VCO. See the diagram in *Figure 5-1* for an illustration of this concept of frequency versus time.

Figure 5-1. VCO Step / Frequency vs. Time



A VCO switches frequency after the input voltage is stepped to another level. In this example, the VCO switches from 9 MHz to 10 MHz. The change in frequency for this VCO should occur in less than 300 microseconds. The VCO signal is shown in *Figure 5-2*.

Figure 5-2. Oscilloscope View of VCO Step Response



SETUP TO MEASURE STEP RESPONSE

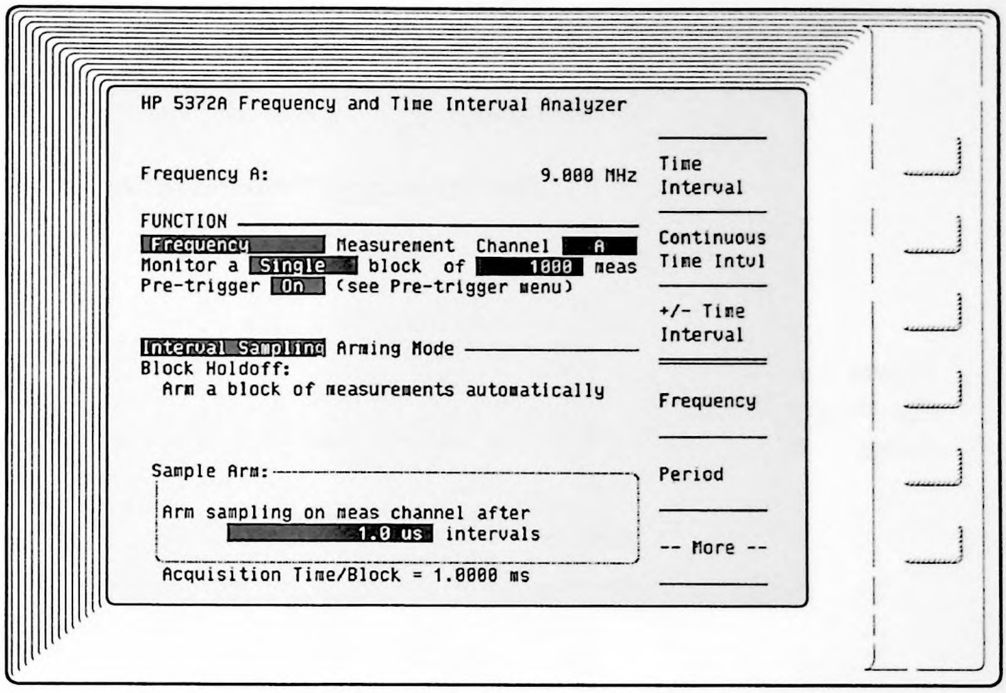
The signal needs to be measured during the time the VCO moves from one frequency to another. The measurement should begin just before the voltage step and continue until after the VCO has settled at the new frequency.

The measurement setup screens included here are as they would be set to make this kind of measurement. Use them as a guide for your measurement situations.

Function Menu

The Function menu is set as shown in *Figure 5-3*.

Figure 5-3.
Function Menu Setup



The Function menu is set to make 1,000 frequency measurements on Channel A. This measurement setup makes use of another feature of the HP 5372A called Pre-trigger. Pre-trigger allows the HP 5372A to monitor the input signal while waiting for an event specified by the user. Once that event occurs, data before and after that event can be captured.

The Pre-trigger event is defined on the Pre-trigger menu. The block of 1,000 continuous measurements represents the behavior of the VCO during 1 ms. Each measurement is collected over a 1 μs interval (1000 × 1μs = 1ms).

TECHNICAL COMMENT

The measurement intervals may not be exactly 1 μs, because (as with all reciprocal counters) each measurement is synchronized to the input signal. Measurements begin and end only at a trigger event of the input signal.

Pre-trigger Menu

This is where the Pre-trigger event is defined. It is also the place to specify the portion of the block of measurements to collect prior to the Pre-trigger event. The portion can be specified as a number of measurements, or a percentage of the block.

The Pre-trigger menu is set as shown in *Figure 5-4*.

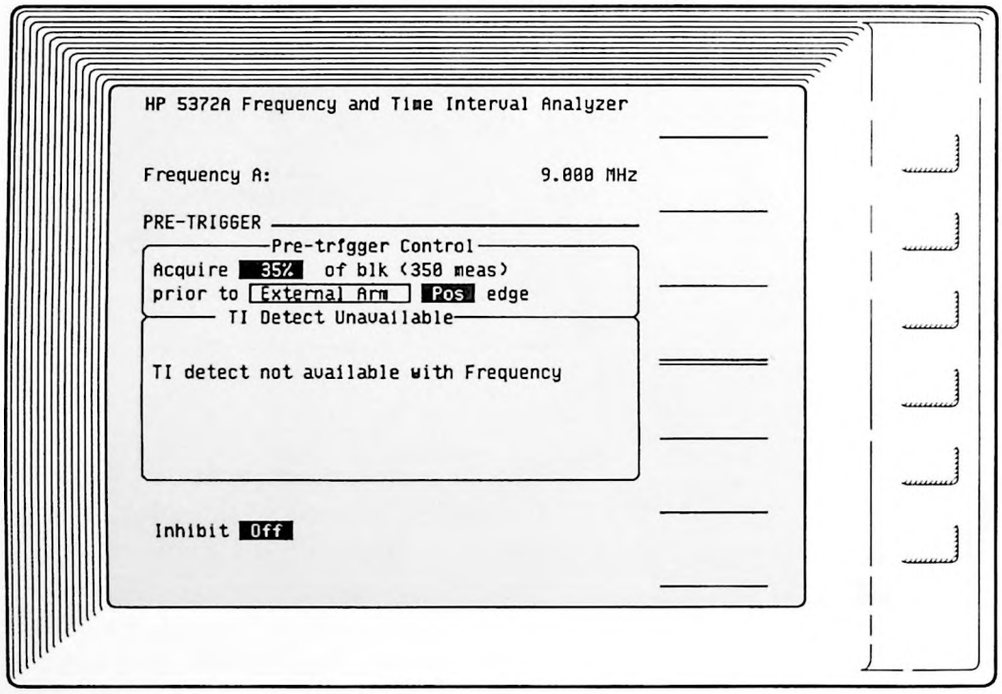


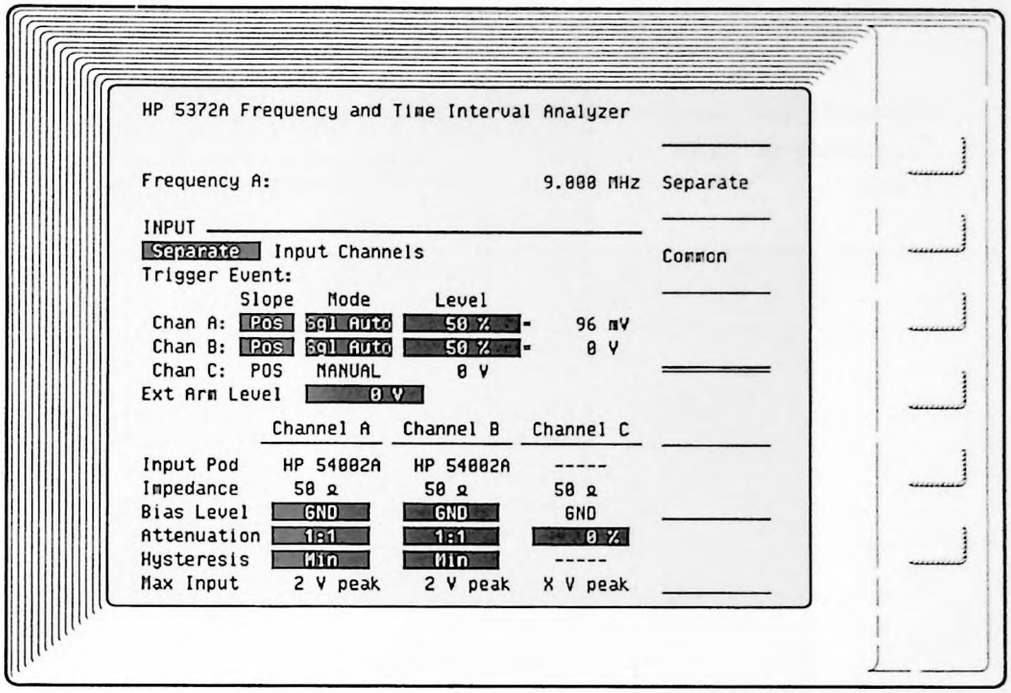
Figure 5-4. Pre-trigger Menu Setup

The block of 1,000 continuous measurements will be acquired around (before and after) the rising (Positive) edge of the VCO step voltage at the External Arm input — in this case, 350 measurements before it and 650 after it.

Input Menu

The Input menu is set as shown in *Figure 5-5*.

Figure 5-5.
Input Menu Setup



TECHNICAL COMMENT

The Input menu lets you define a trigger event. In this case, Single Auto triggering mode at a 50% level has been selected. This mode determines voltage trigger levels at the beginning of the first block of measurements. Manual triggering is necessary for signals less than 1 kHz or greater than 200 MHz. Use Manual triggering also when you are measuring a non-repetitive, or non-CW, signal.

WHAT CAN BE LEARNED FROM MEASUREMENT RESULTS

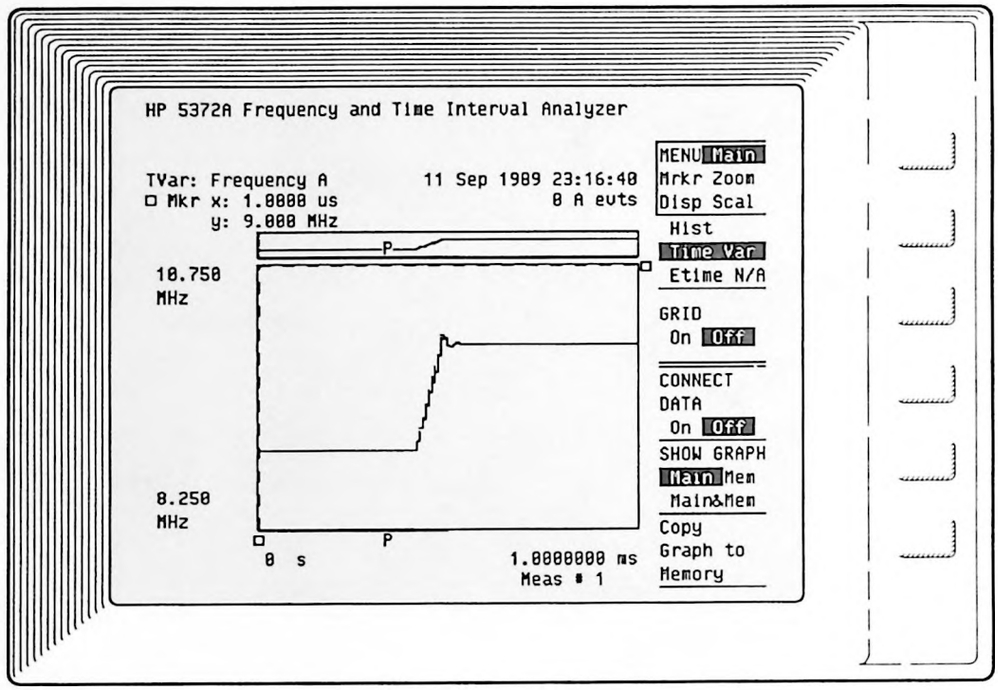
The HP 5372A can directly show the VCO frequency as it changes over time. The frequency data can be analyzed for:

- the settling time (the time it takes the VCO to switch and settle to a new frequency)
- the overshoot (a measure of how much the VCO exceeded the target frequency before settling to the new value)

Shown here are a series of display screens with typical results. Each screen is accompanied by an explanation of what is being displayed.

VCO Step Response

Figure 5-6. Frequency vs. Time View



This Time Variation graph in *Figure 5-6* shows:

- the frequency results along the y-axis, the time of the measurement along the x-axis
- VCO stepping from 9 MHz to 10 MHz
- a total time for the measurement of approximately 1 ms
- the Pre-trigger event identified on the graph with a "P"
- as defined on the Pre-trigger menu, one-third of the 1,000 measurements are before the Pre-trigger event and two-thirds after the event

VCO Settling Time

The settling time of the VCO is measured from the graph using some of the analysis features of the HP 5372A. The sequence of steps to do this is summarized here.

1. Markers set to enclose the area of interest. See *Figure 5-7*.

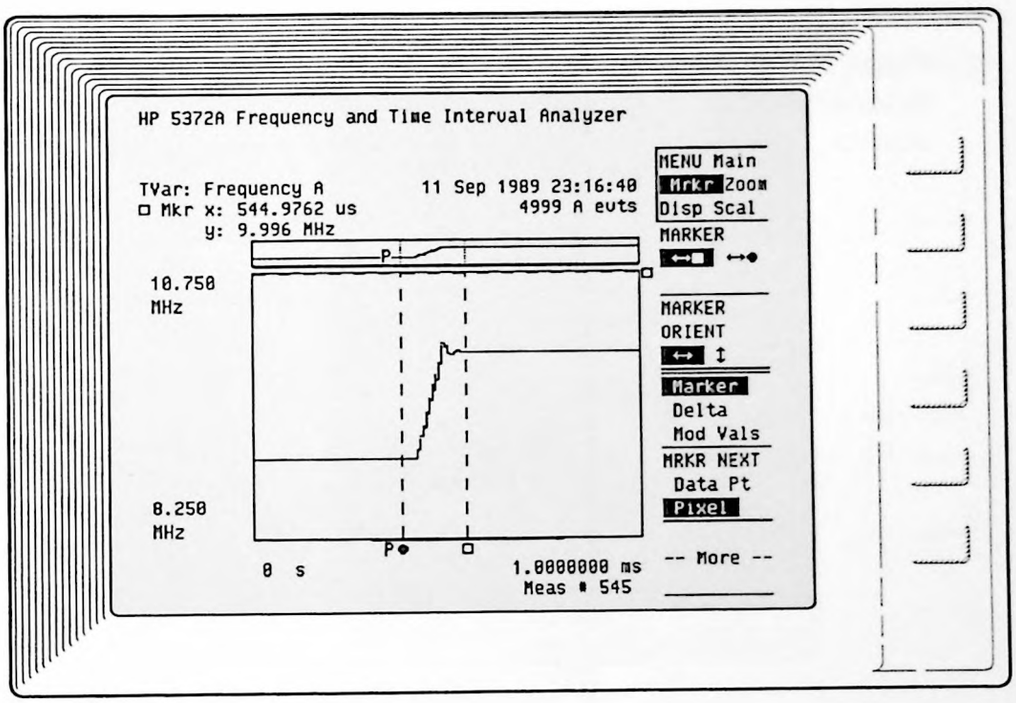


Figure 5-7.
Area of Interest

2. Zoom in on area of interest.

This is done with Scaling features. First the marker positions are copied as the x-axis minimum and maximum values (**Marker Range Hold X-axis** softkey), and then the Manual Scale feature for the x-axis is turned on. See *Figure 5-8*.

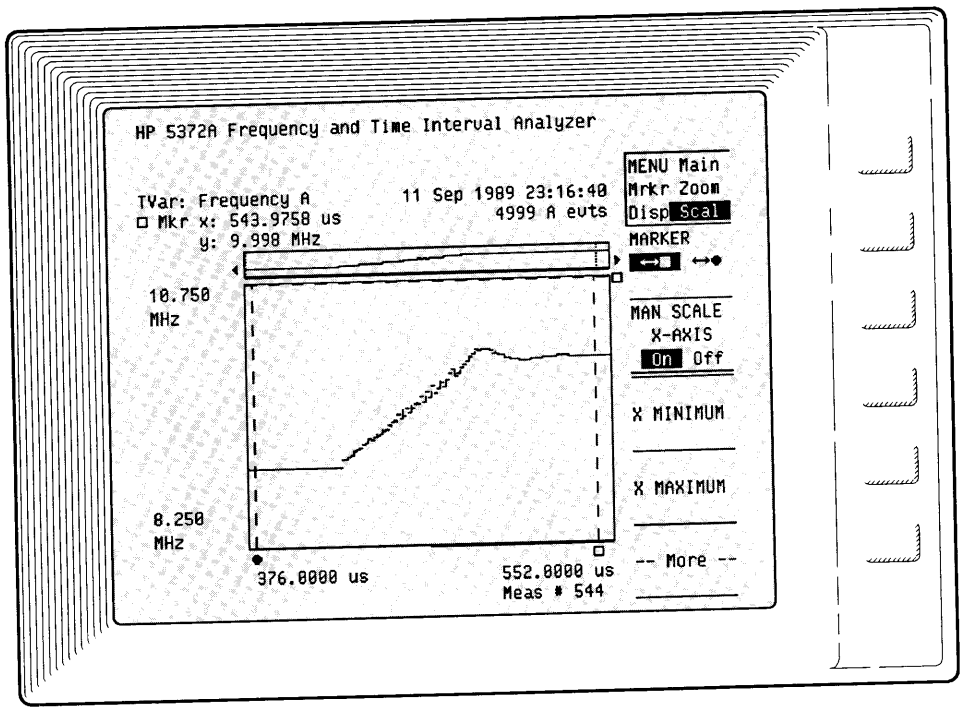
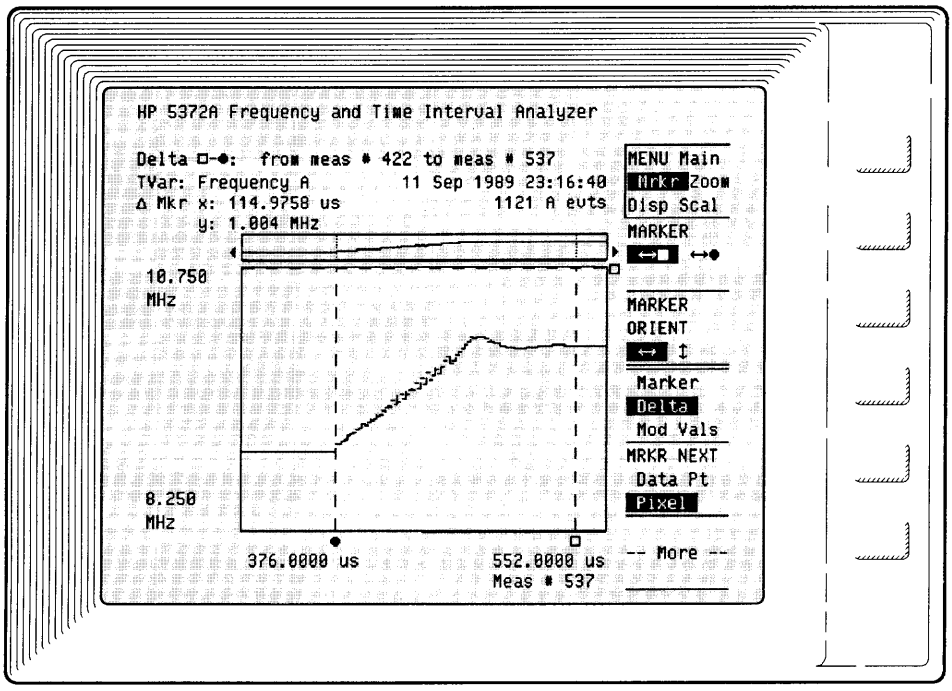


Figure 5-8. Rescaled Area of Interest

3. Measure settling time of the VCO.

The markers are set to enclose the transition, and the Delta feature displays the x-axis time between the markers. See *Figure 5-9*.

Figure 5-9.
VCO Settling Time



The graph shows:

- close-up of frequency step
- one marker set at start of frequency step, the other at the point where the frequency settles at 10 MHz
- an x-axis delta value of 115 μs, well within the specification of 300 μs for the VCO in this example

VCO Overshoot

The markers are positioned for a measurement of the overshoot. See *Figure 5-10*.

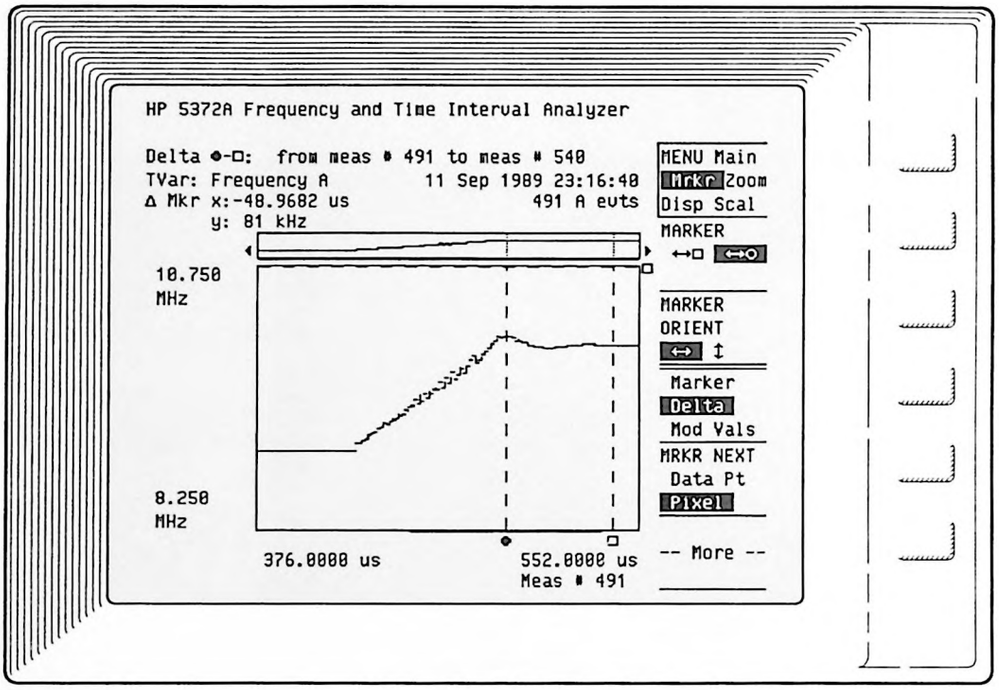


Figure 5-10. Overshoot Measurement

The graph shows:

- one marker set at the point of maximum frequency in the step, the other at the settled frequency value
- the Delta feature displays a difference of 81 kHz as the amount by which the VCO exceeded the target frequency before settling to 10 MHz

RELATED FEATURES

There are other features of the HP 5372A that could provide alternate ways of making this VCO measurement, depending on what needs to be learned from the measurement. Refer to Operating Manual for more information on the following features:

Time Stamp the Block Holdoff Arming Edge

Certain arming modes for frequency measurements can reference the start of the measurements to the voltage that steps the VCO. All measurements are then referenced to this block arming edge.

Average Time Variation Plots

Multiple "passes" of data can be averaged and plotted on Time Variation graphs. The benefit is increased frequency resolution.

Delay Measurements

Time/Interval arming can be used to delay measurements until the point where the VCO is supposed to have settled to the new frequency. This is a way of limiting the measurement only to a portion of the signal in which you are interested.

Limit Testing

The Limits feature on the Math menu can be used to set a minimum and maximum range representative of a VCO specification. The feature can check for any deviations outside of the entered specification min/max range. A Numeric screen (Limit Status) can display the exact number, as well as the percentage, of measurements that were high, low, and within the specification range.

As you spend more time with the HP 5372A, you will find new ways to solve your measurement challenges.

CHAPTER 5 SUMMARY

This chapter reviewed a basic VCO measurement possible with the HP 5372A. The features described show the flexibility and power of the HP 5372A to make and analyze VCO measurements.

CHAPTER 6 PREVIEW

Chapter 6 presents a summary of a jitter measurement application for the HP 5372A. Review the chapter for ideas on how the HP 5372A can help you solve your measurement problems.

6

DATA-TO-CLOCK JITTER EXAMPLE

CHAPTER OVERVIEW

This chapter shows an example of a jitter measurement with the HP 5372A. It is not intended to be a step-by-step procedure to making all jitter measurements, but rather it is a guide to making one type of jitter measurement.

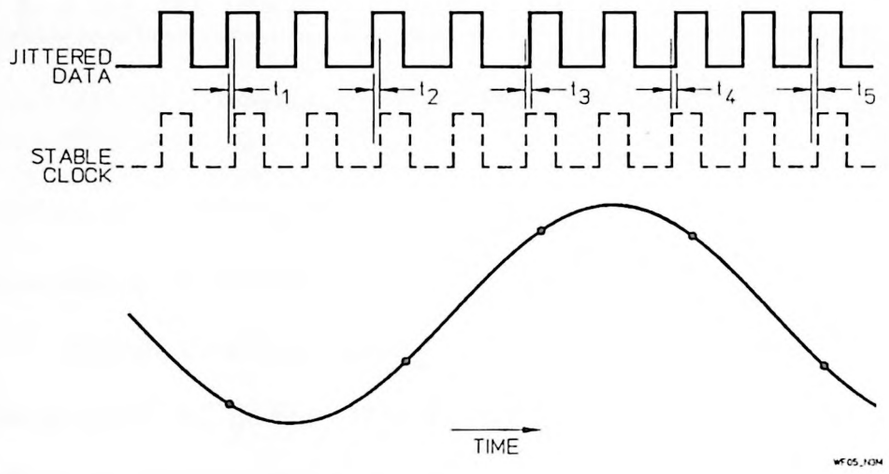
This chapter describes the following topics:

- The data and clock signals
- How the HP 5372A could be set to measure the signals
- What could be learned from the measurement results

THE SIGNALS TO BE MEASURED

In this example, the data-to-clock jitter of a data signal and a clock signal from a digital communications network will be measured. Jitter is the effect of the data edge varying in time relative to the clock. *Figure 6-1* shows a sample of data and clock signals and the actual jitter waveform available from the HP 5372A.

Figure 6-1.
Data-to-Clock Jitter



SETUP TO MEASURE JITTER

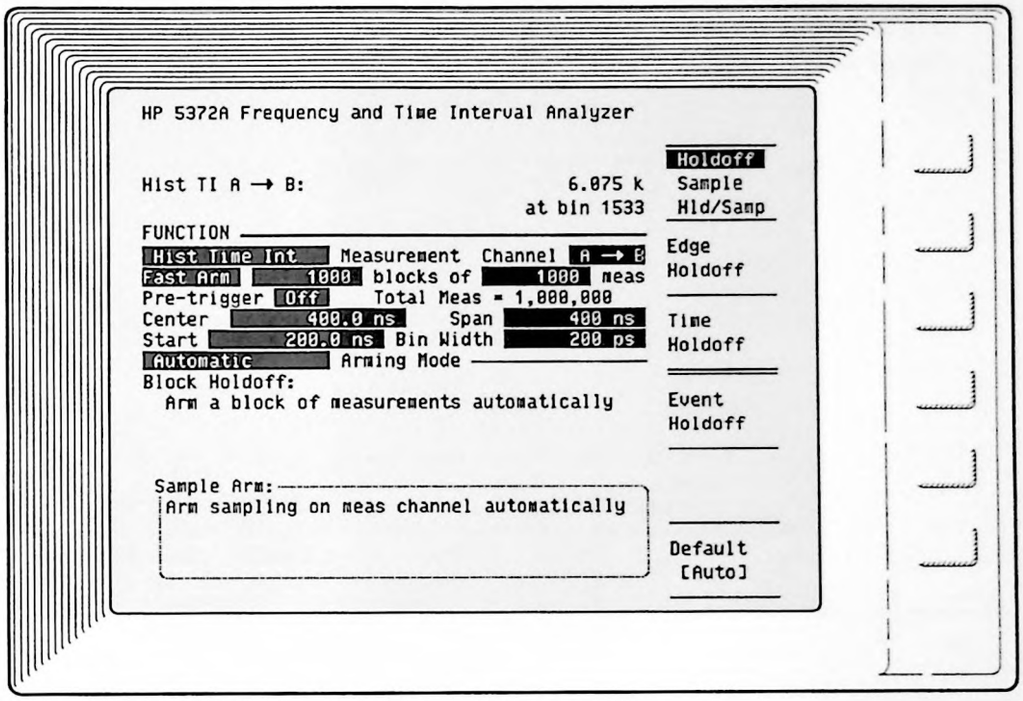
Data-to-clock jitter is the variation in data edge-to-clock edge time intervals. This measurement will consist of a number of time interval measurements from the data edge to the clock edge.

The measurement setup screens included here are as they would be set to make this kind of measurement. Use them as a guide for your measurement situations.

Function Menu

The Function menu is set as shown in *Figure 6-2*.

Figure 6-2.
Function Menu Setup



A Histogram Time Interval measurement is used here so a statistically significant sample size can be acquired in a reasonable amount of time. One million measurements are collected and displayed in a Histogram graph.

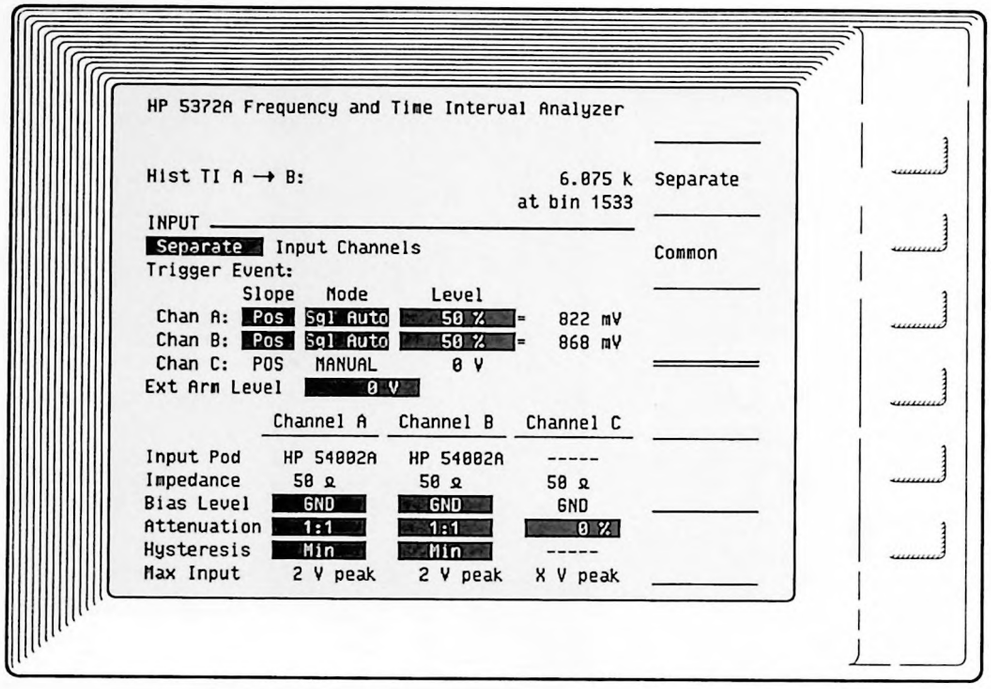
TECHNICAL COMMENT

The Histogram measurements of the HP 5372A (Histogram Time Interval, Histogram Continuous Time Interval, and Histogram +/- Time Interval) can handle very large amounts of data by sorting the data into histogram bins at the measurement rate of the HP 5372A.

Input Menu

The Input menu is set as shown in *Figure 6-3*.

Figure 6-3.
Input Menu Setup



WHAT CAN BE LEARNED FROM MEASUREMENT RESULTS

The HP 5372A can provide graphical and statistical analysis of timing jitter. This example shows a histogram plot of the measured time intervals. The Statistics feature displays the mean and standard deviation of the measurement results.

Jitter Histogram

Figure 6-4 shows a histogram of 1,000,000 data-to-clock measurements.

Jitter Statistics

Figure 6-5 shows statistics on the Histogram graph data. The Histogram graph of the time interval measurements shows the data-to-clock jitter of the input signals. The mean value indicates that the delay between data and clock averages 508 ns. The standard deviation is 16 ns. These values can help evaluate the performance of a digital communications network, or any synchronous system where data must be reliably clocked.

Figure 6-4. Histogram of Data-to-Clock Jitter

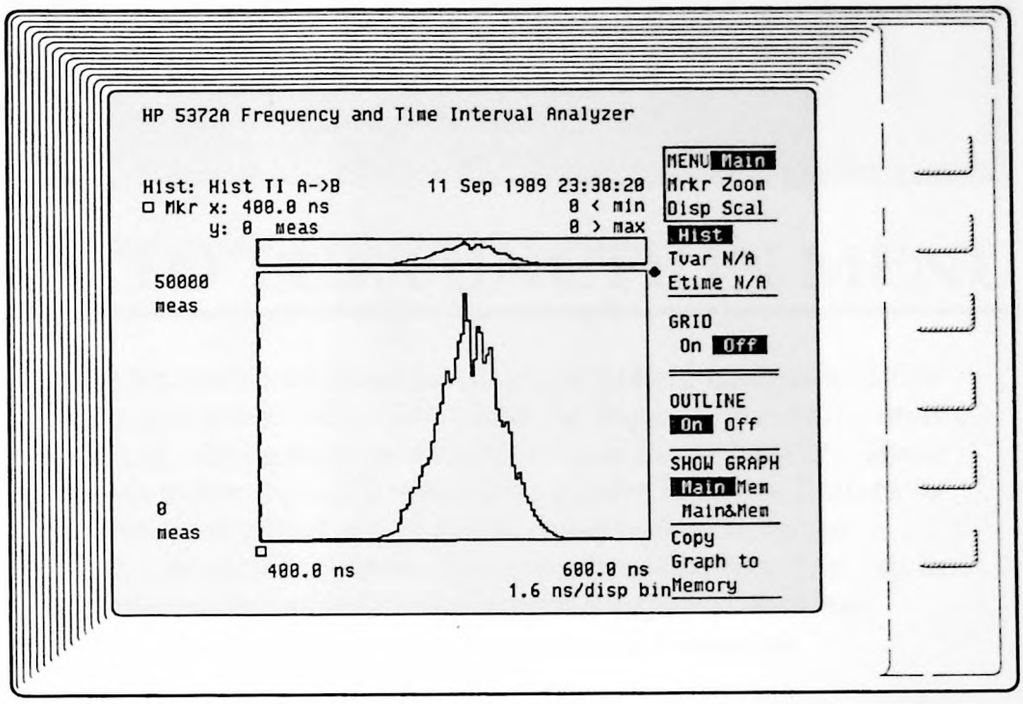
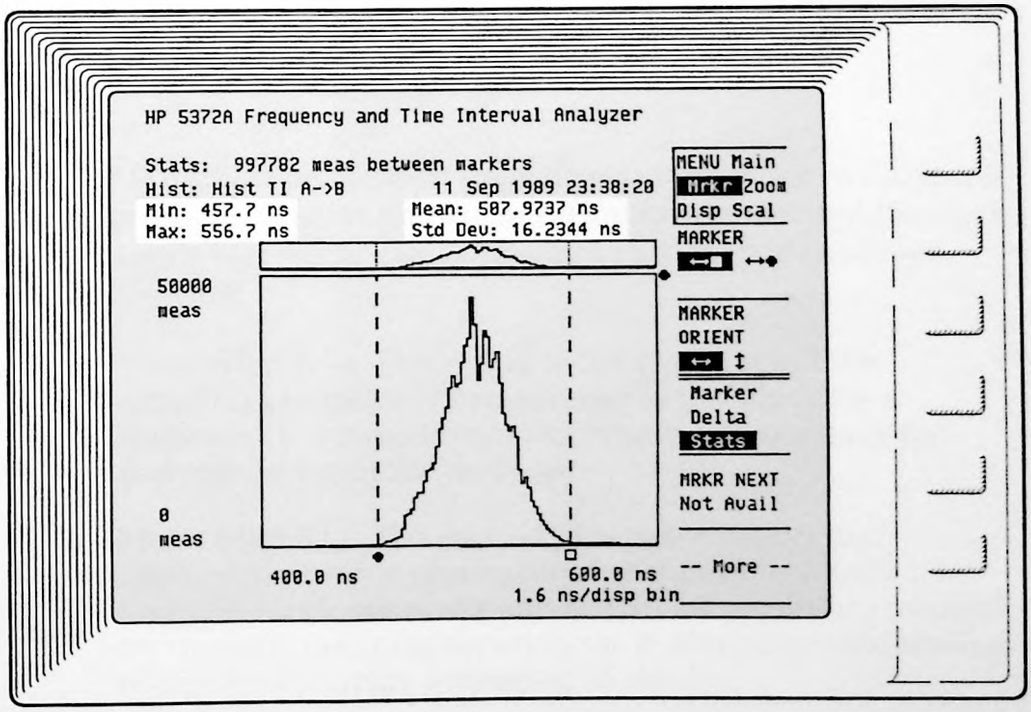


Figure 6-5. Histogram with Statistics



CHAPTER 6 SUMMARY

This chapter reviewed a time interval measurement application. In the example described here, a Histogram measurement was used to acquire and analyze a large sample size (1,000,000 measurements). Refer to *Operating Manual* for more information on any of the topics discussed in this getting started guide.

APPENDIX

A

A GUIDE TO THE FUNCTION MENU

INTRODUCTION

Use this series of three menu maps to help understand the effects of the arming mode and the measurement size on the type of results that are available from the HP 5372A. These menu maps should be used as a guide. They are limited to showing single-channel measurements for the major measurement functions. The principles documented can be applied to the other measurement functions, once you understand the characteristics of those functions.

The following chapters of the Operating Manual should be used as reference material for this guide:

- Chapter 1, Time Interval Measurements
- Chapter 2, Frequency/Period Measurements
- Chapter 7, Function Menu
- Chapter 10, Pre-trigger Menu

OVERVIEW OF MENU MAPS

The flowchart on the next page directs you to one of the menu maps depending on the size of the measurement and the kind of results you want. The purpose of each map is described briefly here:

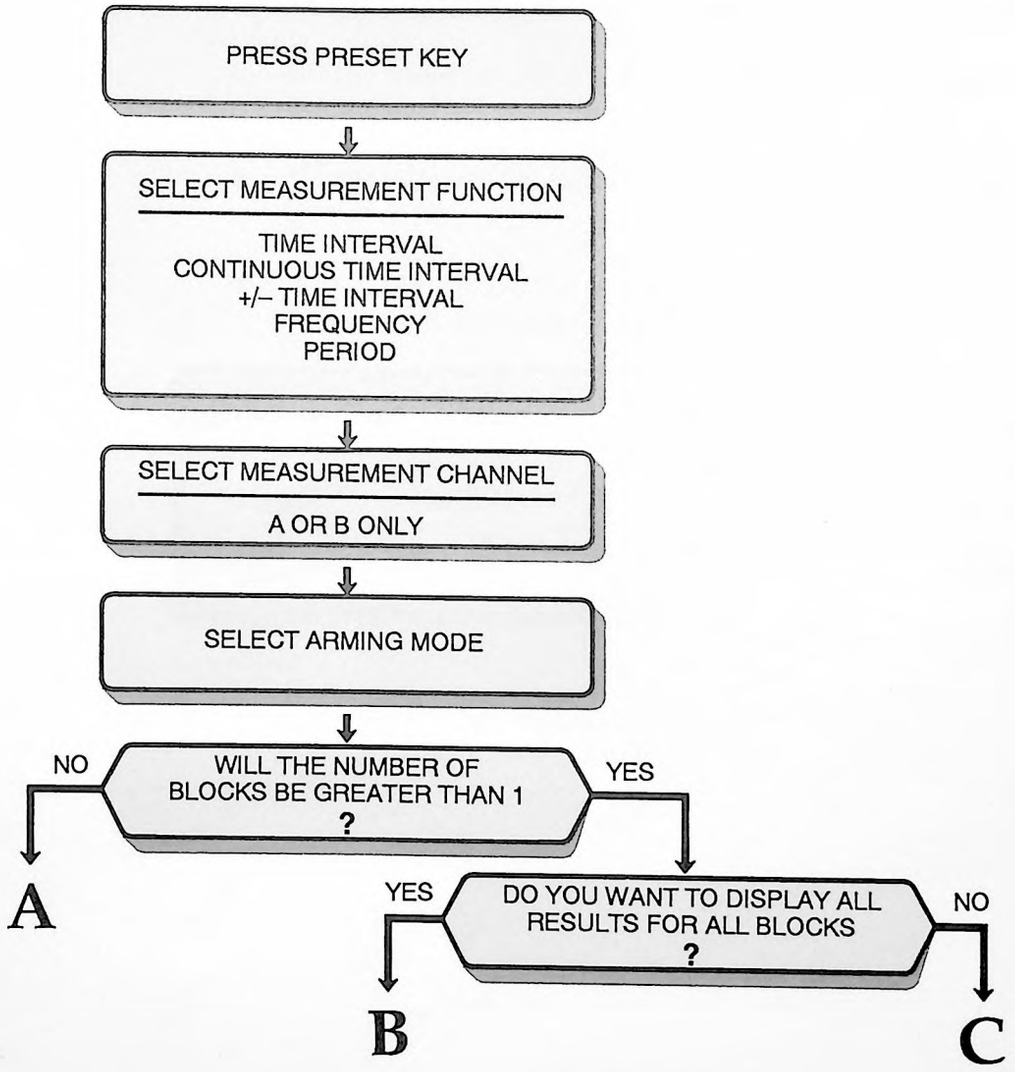
- Menu Map A — This menu helps you to select the maximum number of measurements per block for a single-block measurement. All results are available for numeric and graphic analysis.
- Menu Map B — This menu helps you to select the maximum number of measurements per block for a multiple-block measurement so that all results are available for numeric and graphic analysis. It also shows the arming modes that provide averaging of results.

- Menu Map C — This menu covers the situations where measurement memory could be exceeded as a result of the multiple-block measurement size. When all the measurements will not fit in memory, not all results are available for review. There are times when this is preferrable to using smaller measurement sizes. Some advantages are:
  - All the measurement values are included in statistics.
  - All the measurement values are included in limit testing.
  - All measurement values are included in Histogram graphs.
  - When averaging, the final block of measurements includes all the measurement values from each of the blocks.
  - Pre-trigger on multiple blocks provides the advantage of repeated execution of the block holdoff condition while waiting for the pre-trigger event. This sets a reference for each block of measurement data.

See the Following Pages for Menu Maps

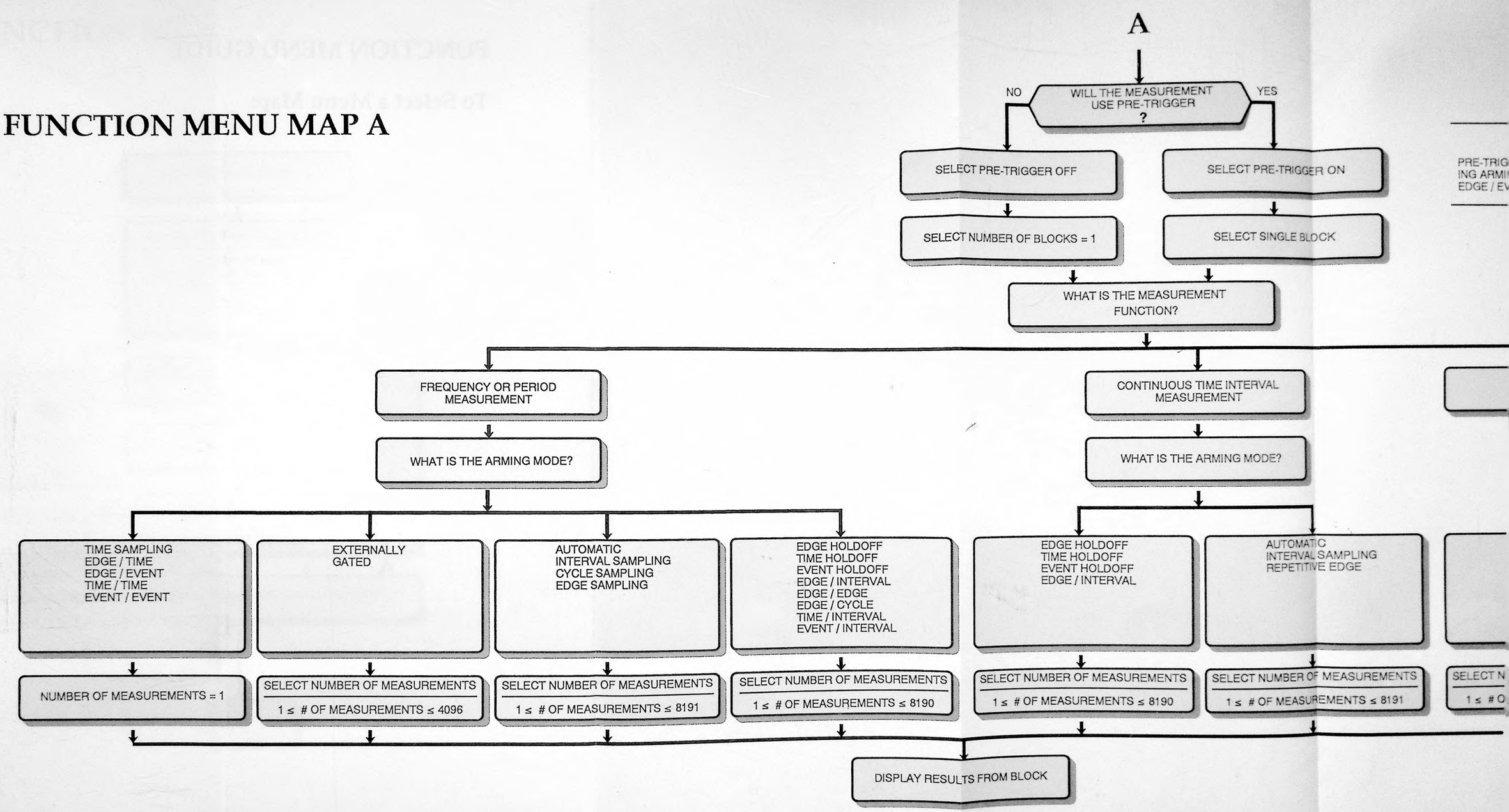
FUNCTION MENU GUIDE

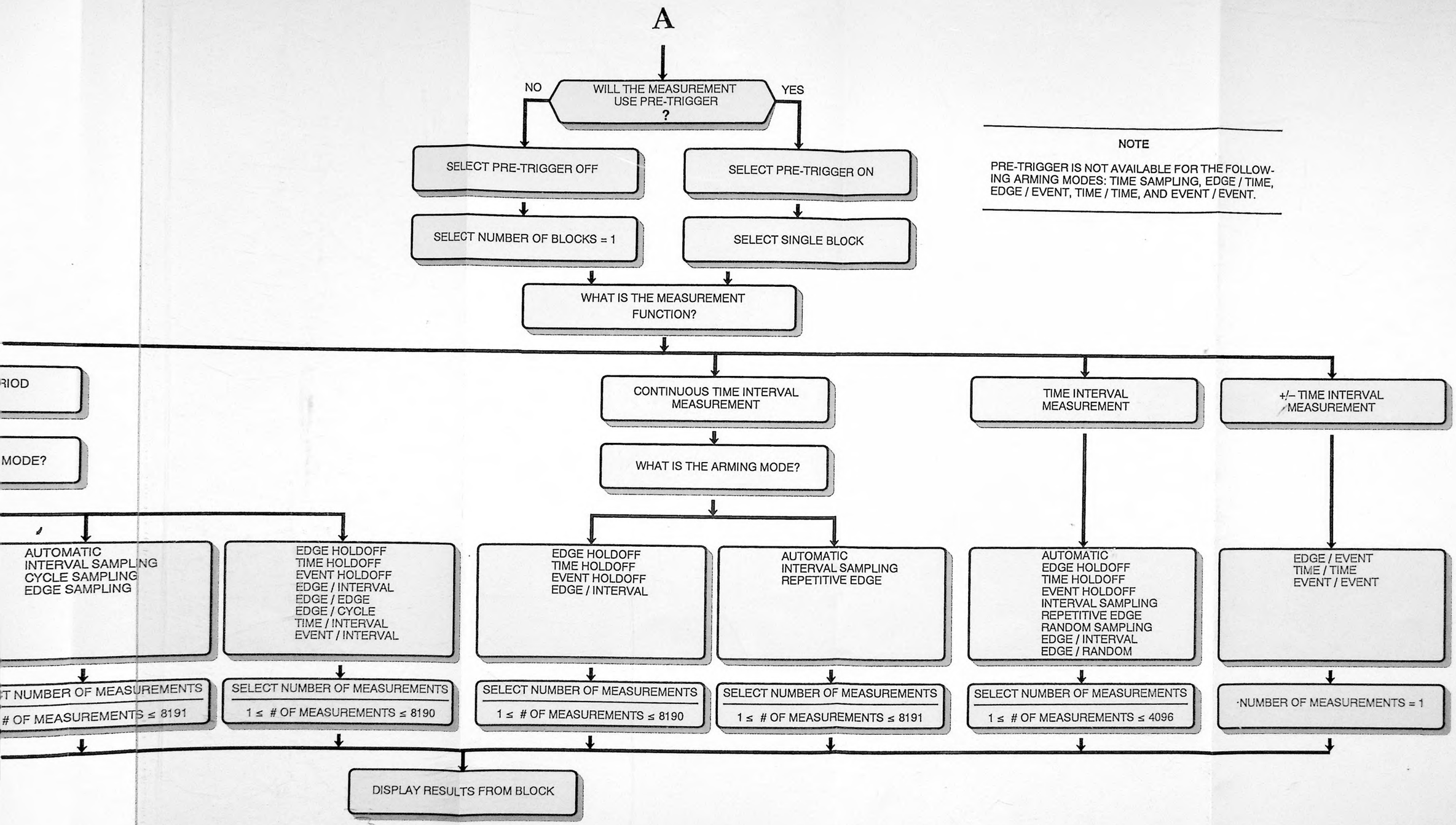
To Select a Menu Map:



BD_TOPN3M

FUNCTION MENU MAP A



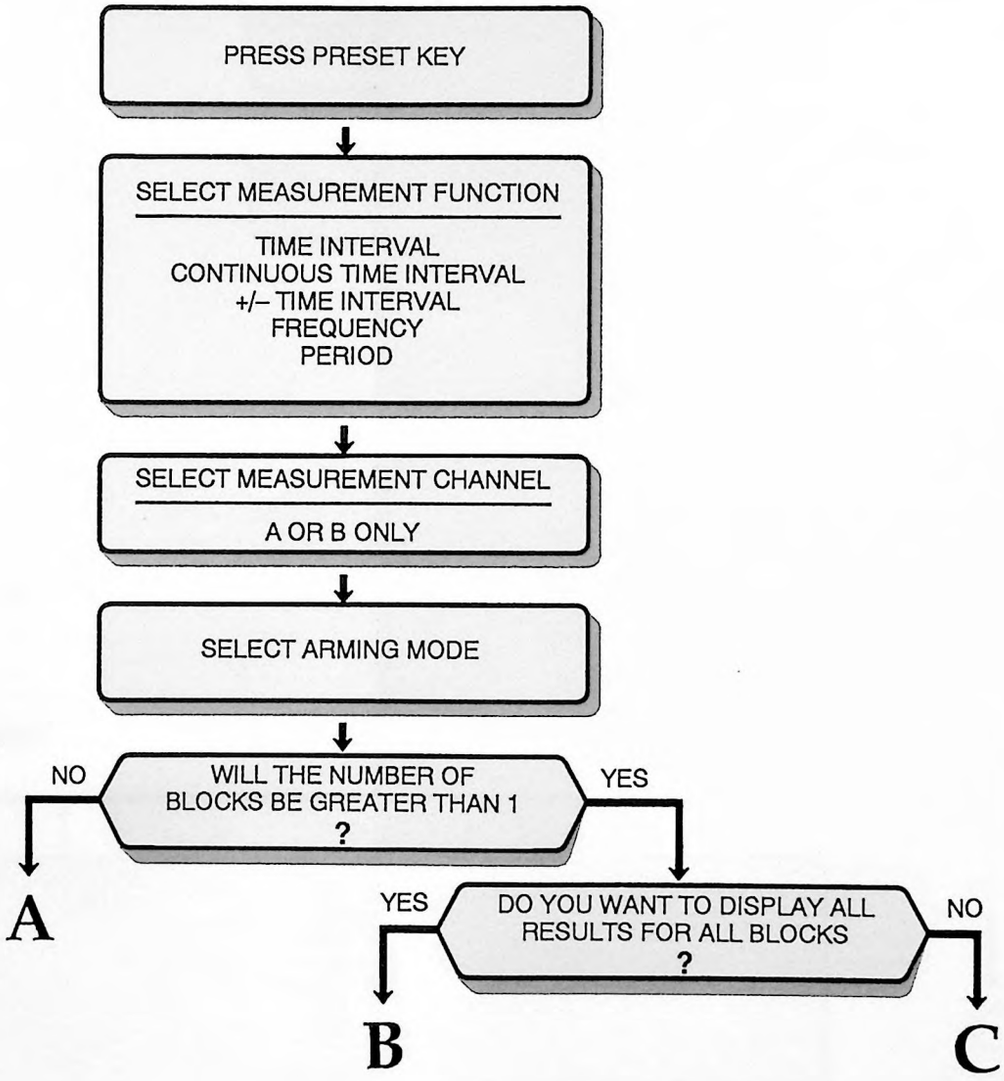


NOTE

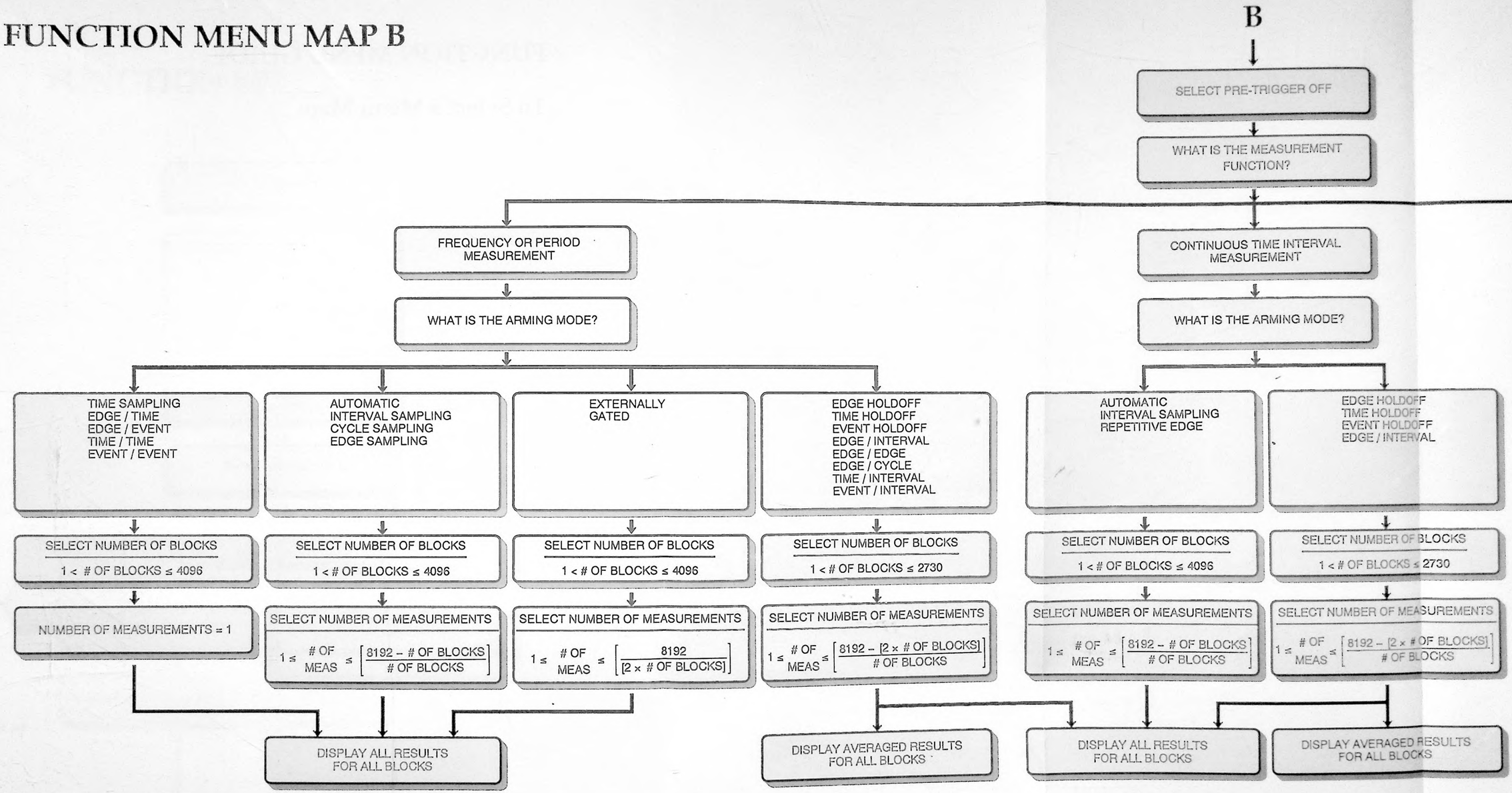
PRE-TRIGGER IS NOT AVAILABLE FOR THE FOLLOWING ARMING MODES: TIME SAMPLING, EDGE / TIME, EDGE / EVENT, TIME / TIME, AND EVENT / EVENT.

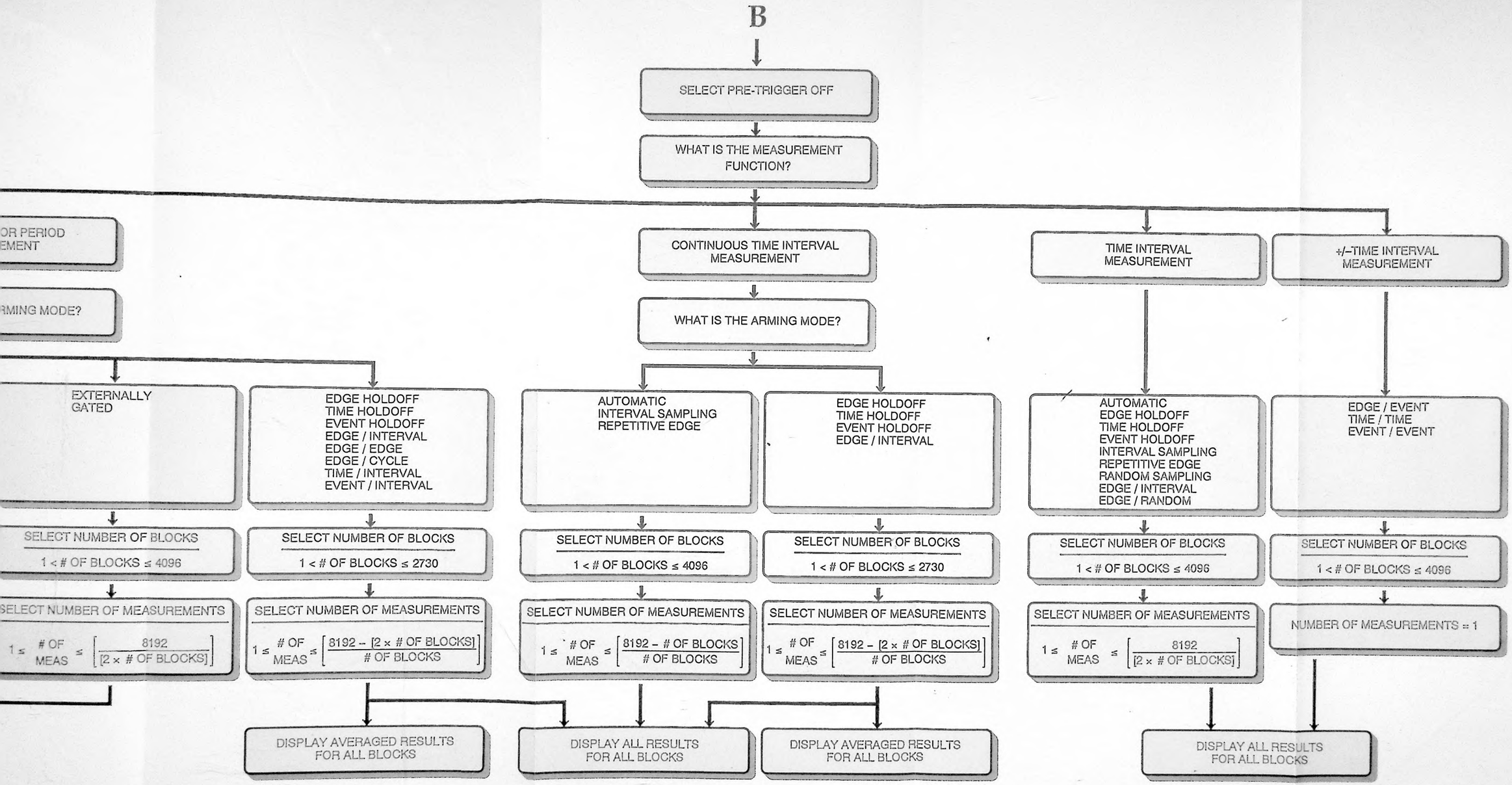
FUNCTION MENU GUIDE

To Select a Menu Map:



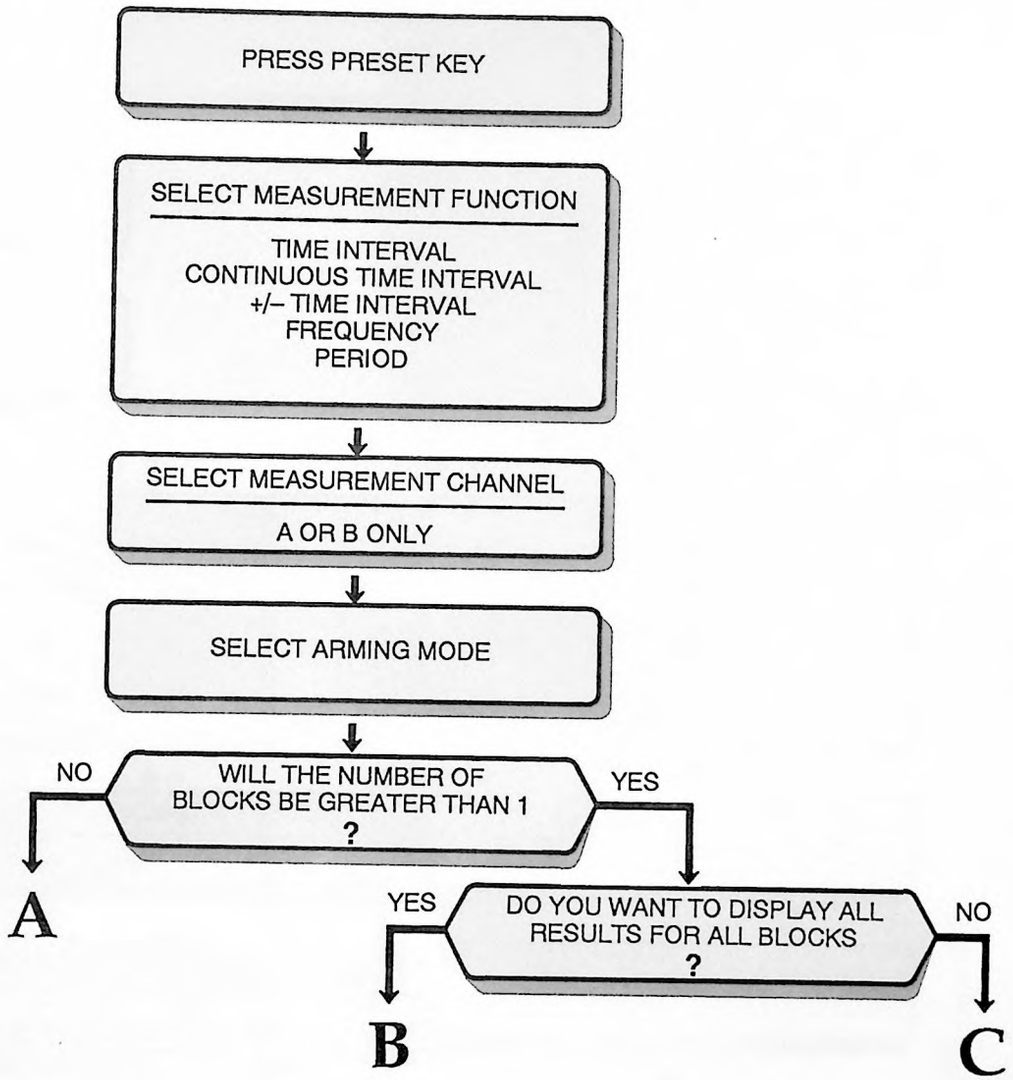
FUNCTION MENU MAP B



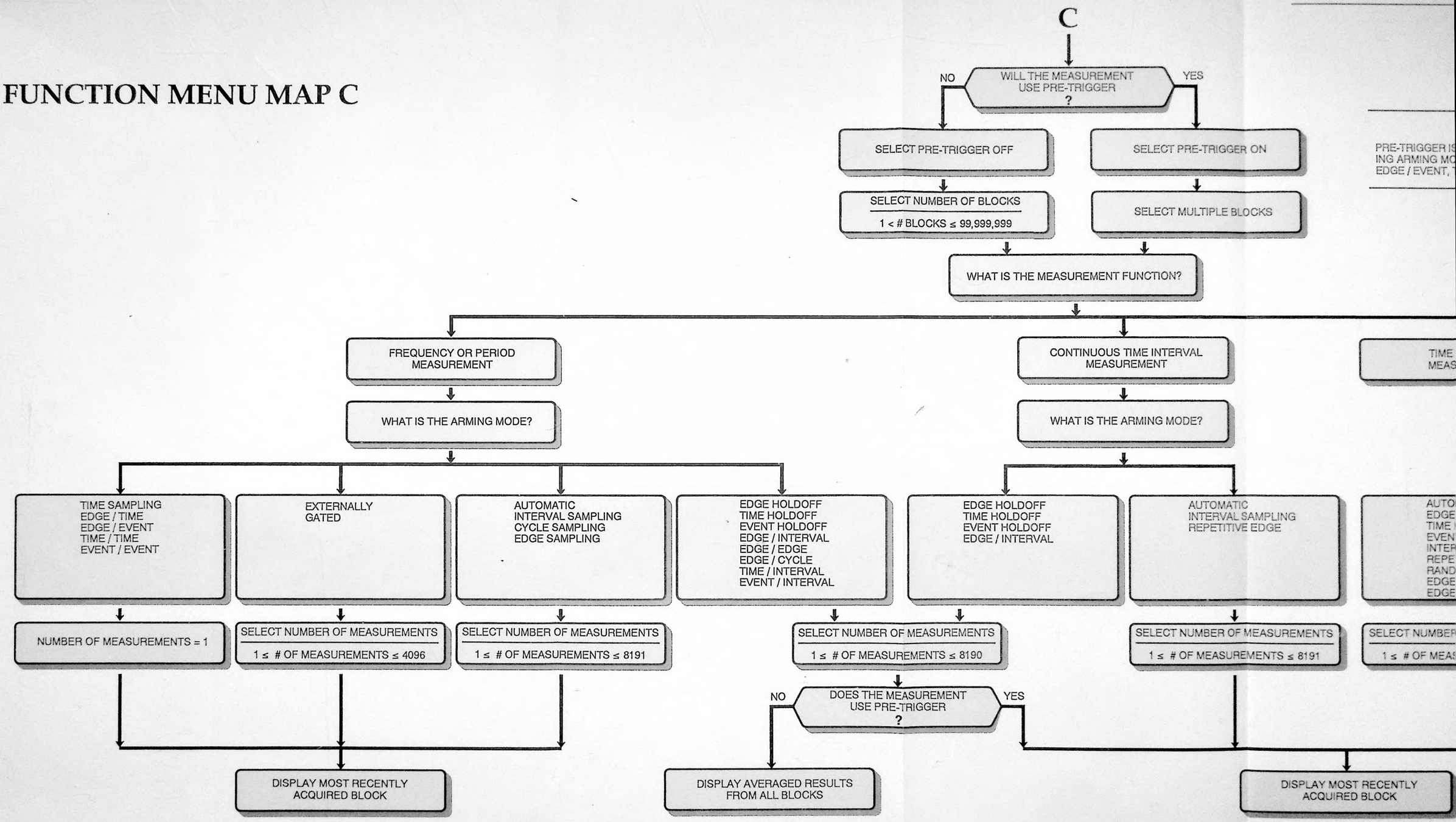

B
SELECT PRE-TRIGGER OFF
WHAT IS THE MEASUREMENT FUNCTION?
OR PERIOD
EMENT
RMING MODE?
EXTERNALLY GATED
SELECT NUMBER OF BLOCKS
1 < # OF BLOCKS ≤ 4096
SELECT NUMBER OF MEASUREMENTS
1 ≤ # OF MEAS ≤ [8192 / (2 × # OF BLOCKS)]
EDGE HOLDOFF
TIME HOLDOFF
EVENT HOLDOFF
EDGE / INTERVAL
EDGE / EDGE
EDGE / CYCLE
TIME / INTERVAL
EVENT / INTERVAL
SELECT NUMBER OF BLOCKS
1 < # OF BLOCKS ≤ 2730
SELECT NUMBER OF MEASUREMENTS
1 ≤ # OF MEAS ≤ [8192 – (2 × # OF BLOCKS) / # OF BLOCKS]
DISPLAY AVERAGED RESULTS FOR ALL BLOCKS
CONTINUOUS TIME INTERVAL MEASUREMENT
WHAT IS THE ARMING MODE?
AUTOMATIC
INTERVAL SAMPLING
REPETITIVE EDGE
SELECT NUMBER OF BLOCKS
1 < # OF BLOCKS ≤ 4096
SELECT NUMBER OF MEASUREMENTS
1 ≤ # OF MEAS ≤ [8192 – # OF BLOCKS / # OF BLOCKS]
DISPLAY ALL RESULTS FOR ALL BLOCKS
EDGE HOLDOFF
TIME HOLDOFF
EVENT HOLDOFF
EDGE / INTERVAL
SELECT NUMBER OF BLOCKS
1 < # OF BLOCKS ≤ 2730
SELECT NUMBER OF MEASUREMENTS
1 ≤ # OF MEAS ≤ [8192 – (2 × # OF BLOCKS) / # OF BLOCKS]
DISPLAY AVERAGED RESULTS FOR ALL BLOCKS
TIME INTERVAL MEASUREMENT
AUTOMATIC
EDGE HOLDOFF
TIME HOLDOFF
EVENT HOLDOFF
INTERVAL SAMPLING
REPETITIVE EDGE
RANDOM SAMPLING
EDGE / INTERVAL
EDGE / RANDOM
SELECT NUMBER OF BLOCKS
1 < # OF BLOCKS ≤ 4096
SELECT NUMBER OF MEASUREMENTS
1 ≤ # OF MEAS ≤ [8192 / (2 × # OF BLOCKS)]
DISPLAY ALL RESULTS FOR ALL BLOCKS
+/–TIME INTERVAL MEASUREMENT
EDGE / EVENT
TIME / TIME
EVENT / EVENT
SELECT NUMBER OF BLOCKS
1 < # OF BLOCKS ≤ 4096
NUMBER OF MEASUREMENTS = 1

FUNCTION MENU GUIDE

To Select a Menu Map:



FUNCTION MENU MAP C



C

WILL THE MEASUREMENT USE PRE-TRIGGER ?

NO

SELECT PRE-TRIGGER OFF

SELECT NUMBER OF BLOCKS

1 < # BLOCKS ≤ 99,999,999

YES

SELECT PRE-TRIGGER ON

SELECT MULTIPLE BLOCKS

NOTE

PRE-TRIGGER IS NOT AVAILABLE FOR THE FOLLOWING ARMING MODES: TIME SAMPLING, EDGE / TIME, EDGE / EVENT, TIME / TIME, AND EVENT / EVENT.

WHAT IS THE MEASUREMENT FUNCTION?

REQUENCY OR PERIOD MEASUREMENT

AT IS THE ARMING MODE?

AUTOMATIC
INTERVAL SAMPLING
CYCLE SAMPLING
EDGE SAMPLING

EMENTS

≤ 4096

SELECT NUMBER OF MEASUREMENTS

1 ≤ # OF MEASUREMENTS ≤ 8191

LY

EDGE HOLDOFF
TIME HOLDOFF
EVENT HOLDOFF
EDGE / INTERVAL
EDGE / EDGE
EDGE / CYCLE
TIME / INTERVAL
EVENT / INTERVAL

CONTINUOUS TIME INTERVAL MEASUREMENT

WHAT IS THE ARMING MODE?

EDGE HOLDOFF
TIME HOLDOFF
EVENT HOLDOFF
EDGE / INTERVAL

SELECT NUMBER OF MEASUREMENTS

1 ≤ # OF MEASUREMENTS ≤ 8190

NO

DOES THE MEASUREMENT USE PRE-TRIGGER ?

YES

DISPLAY AVERAGED RESULTS FROM ALL BLOCKS

AUTOMATIC
INTERVAL SAMPLING
REPETITIVE EDGE

SELECT NUMBER OF MEASUREMENTS

1 ≤ # OF MEASUREMENTS ≤ 8191

TIME INTERVAL MEASUREMENT

AUTOMATIC
EDGE HOLDOFF
TIME HOLDOFF
EVENT HOLDOFF
INTERVAL SAMPLING
REPETITIVE EDGE
RANDOM SAMPLING
EDGE / INTERVAL
EDGE / RANDOM

SELECT NUMBER OF MEASUREMENTS

1 ≤ # OF MEASUREMENTS ≤ 4096

+/– TIME INTERVAL MEASUREMENT

EDGE / EVENT
TIME / TIME
EVENT / EVENT

NUMBER OF MEASUREMENTS = 1

DISPLAY MOST RECENTLY ACQUIRED BLOCK

APPENDIX
B

UNPACKING AND INSTALLING

INTRODUCTION

This section provides installation instructions including unpacking, initial inspection, storage, and shipment information for the HP 5372A Frequency and Time Interval Analyzer.

UNPACKING AND INSPECTION

WARNING

TO AVOID HAZARDOUS ELECTRIC SHOCK, DO NOT PERFORM ELECTRICAL TESTS WHEN THERE ARE SIGNS OF SHIPPING DAMAGE TO ANY PORTION OF THE OUTER ENCLOSURE (COVERS, PANELS, CONNECTORS, LEDS, ETC.).

Inspect the shipping container and cushioning material for damage. If damage is evident, keep the packing materials until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument or some component fails the performance tests, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection. The HP office will arrange for repair or replacement at HP's option without waiting for a claim settlement.

PREPARATION FOR USE

Operating Environment

TEMPERATURE. The instrument may be operated in temperatures from 0° C to 40° C.

Bench Operation

The instrument has plastic feet and folding tilt stands for convenience in bench operation. (The plastic feet are shaped to facilitate self-alignment when stacking instruments.

WARNING

THE HP5372A WEIGHS 26.8 KG (59 LBS). CARE MUST BE TAKEN WHEN LIFTING THE INSTRUMENT TO AVOID PERSONAL INJURY. USE EQUIPMENT SLIDES WHEN RACK MOUNTING (FOR DETAILS, REFER TO PARAGRAPH TITLED "RACK MOUNTING KITS").

Power Requirements

The HP 5372A can operate from power sources of 100-, 120-, 220-, or 240-volt ac, +10%, –10%, 50 to 60 Hertz for all voltages, 400 Hertz for 100- and 120-volt ac. Maximum power consumption is 500 volt-amperes.

WARNING

THIS IS A SAFETY CLASS I PRODUCT PROVIDED WITH A PROTECTIVE EARTH TERMINAL. AN UNINTERRUPTIBLE SAFETY EARTH GROUND MUST BE PROVIDED FROM THE MAINS POWER SOURCE TO THE PRODUCT INPUT WIRING TERMINALS, POWER CORD, OR SUPPLIED POWER CORD SET. WHENEVER IT IS LIKELY THAT THE PROTECTION HAS BEEN IMPAIRED, THE INSTRUMENT MUST BE MADE INOPERATIVE AND BE SECURED AGAINST ANY UNINTENDED OPERATION.

IF THIS INSTRUMENT IS TO BE ENERGIZED VIA AN EXTERNAL AUTOTRANSFORMER FOR VOLTAGE REDUCTION, MAKE SURE THAT THE COMMON TERMINAL IS CONNECTED TO THE EARTHED POLE OF THE POWER SOURCE. FAILURE TO GROUND THE INSTRUMENT CAN RESULT IN PERSONAL INJURY. REFER TO THE PARAGRAPH TITLED "Power Cable".

Line Voltage and Fuse Selection

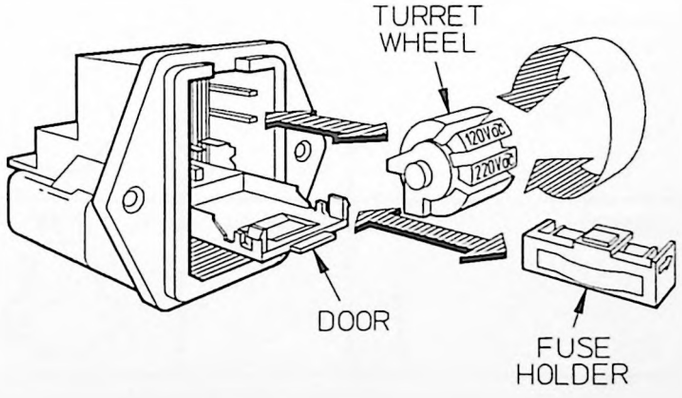
CAUTION

BEFORE PLUGGING THIS INSTRUMENT into the Mains (line) voltage, be sure the correct line voltage and fuse have been selected. You must set the voltage selector turret wheel correctly to adapt the HP 5372A to the power source as described in the following paragraph.

The HP 5372A is equipped with a power module (on the rear panel) that contains a turret wheel line voltage selector to select 100-, 120-, 220-, or 240-volt ac operations as shown in *Figure B-1*. Before applying power to the 5372A, the turret wheel selector must be set to the correct position and the correct fuse must be installed as described in the following paragraphs.

Power line connections are selected by the position of the plug-in turret wheel in the module. The correct-value fuse, with a 250-volt rating, must be installed before the turret wheel is inserted. This instrument uses a 4A fuse (HP Part Number 2110-0055) for 100/120-volt operation and a 2A fuse (HP Part Number 2110-0002) for 220/240-volt operation.

To change the line voltage, first disconnect the power cord from the module and then follow the instructions in *Figure B-1*.



SELECTION OF OPERATING VOLTAGE

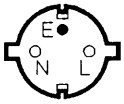
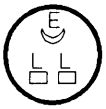
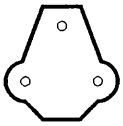
1. Using a small, flat-head screwdriver, snap open the power module door to access the fuse and turret wheel.
2. REMOVE the turret wheel before turning to desired voltage. DO NOT turn turret wheel while installed in module. Push wheel firmly into module slot.
3. To change or install fuse, pull fuse holder and reinsert fuse in holder, using caution to select correct fuse value. Re-insert fuse and holder.
4. Close the power module door. The selected operating voltage is shown in module window.

Figure B-1. Line Voltage Selection with Power Module Turret Wheel.

Power Cable

This instrument is equipped with a three-wire power cable. When connected to an appropriate ac power receptacle, this cable grounds the instrument cabinet. The type of power cable shipped with each instrument depends on the country of destination. Refer to *Table B-1* for the part number of the power cables and mains plugs available.

Table B-1. AC Power Cables Available

Plug Type	Cable HP Part No.	*CD	Plug Description	Cable Length (inches)	Cable Color	For Use In Country
250V 	8120-1351 8120-1703	0 6	Straight **BS1363A 90°	90 90	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Rhodesia, Singapore
250V 	8120-1369 8120-0696	0 4	Straight **NZSS198/ASC112 90°	79 87	Gray Gray	Australia, New Zealand
250V 	8120-1689 8120-1692	7 2	Straight **CEE7-Y11 90°	79 79	Mint Gray Mint Gray	East and West Europe, Egypt, (Unpolarized in many nations)
125V 	8120-1348 8120-1398 8120-1754 8120-1378 8120-1521 8120-1676 8120-4753	5 5 7 1 6 2	Straight **NEMA5-15P 90° Straight **NEMA5-15P Straight **NEMA5-15P 90° Straight **NEMA5-15P Straight **NEMA5-15P	80 80 36 80 80 30 90	Black Black Black Jade Gray Jade Gray Jade Gray Dark Gray	United States, Canada, 100V or 200V, Mexico, Philippines, Taiwan, Saudi Arabia, Japan
250V 	8120-2104	3	Straight **SEV1011 1959-24507 Type 12	79	Gray	Switzerland
250V 	8120-0698	6	Straight **NEMA6-15P			United States, Canada
220V 	8120-2956 8120-2957	2 3	Straight **DHCK 107 90°	79 79	Gray Gray	Denmark
220V 	8120-4211 8120-4600		Straight 90°		Gray Gray	South Africa, India

*CD = Check Digit (refer to Replaceable Parts in Service Manual).

**Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug.

E = Earth Ground L = LIne N = Neutral

HEWLETT-PACKARD INTERFACE BUS (HP-IB)

HP-IB Interconnections

HEWLETT-PACKARD INTERFACE BUS. Interconnection data concerning the rear panel HP-IB connector is provided in *Figure B-2*. This connector is compatible with the HP10833A/B/C/D HP-IB cables. The HP-IB system allows interconnection of up to 15 (including the controller) HP-IB compatible instruments. The HP-IB cables have identical "piggy-back" connectors on both ends so that several cables can be connected to a single source without special adapters or switch boxes. System components and devices may be connected in virtually any configuration desired. There must, of course, be a path from the controller to every device operating on the bus. As a practical matter, avoid stacking more than three or four cables on any one connector. If the stack gets too large, the force on the stack produces great leverage which can damage the connector mounting. Be sure each connector is firmly (finger tight) screwed in place to keep it from working loose during use.

CABLE LENGTH RESTRICTIONS. To achieve design performance with the HP-IB, proper voltage levels and timing relationship must be maintained. If the system cable is too long, the lines cannot be driven properly. Therefore, when interconnecting and HP-IB system, it is important to observe the following rules:

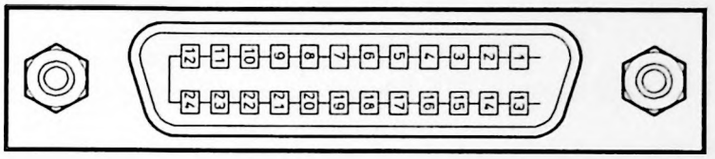
a. The total cable length for the system must be equal to or less than 2 meters (6.6 feet) times the total number of devices connected to the bus.

b. The total cable length for the system must be less than or equal to 20 meters (65 feet).

c. The total number of instruments connected to the bus must not exceed 15.

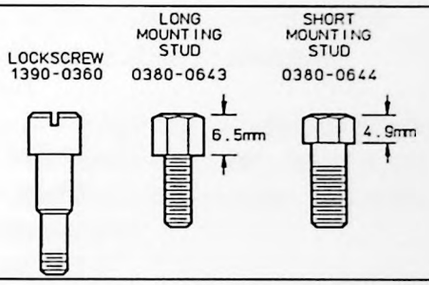
PIN	LINE
1	DIO1
2	DIO2
3	DIO3
4	DIO4
13	DIO5
14	DIO6
15	DIO7
16	DIO8
5	EOI
17	REN
6	DAV
7	NRFD
8	NDAC
9	IFC
10	SRQ
11	ATN
12	SHIELD-CHASSIS GROUND
18	P/O TWISTED PAIR WITH PIN 6
19	P/O TWISTED PAIR WITH PIN 7
20	P/O TWISTED PAIR WITH PIN 8
21	P/O TWISTED PAIR WITH PIN 9
22	P/O TWISTED PAIR WITH PIN 10
23	P/O TWISTED PAIR WITH PIN 11
24	ISOLATED DIGITAL GROUND

THESE PINS ARE INTERNALLY GROUNDED



CAUTION

The 5372A contains metric threaded HP-IB cable mounting studs as opposed to English threads. Metric threaded HP 10833A, B, C, or D HP-IB cable lockscrews must be used to secure the cable to the instrument. Identification of the two types of mounting studs and lockscrews is made by their color. English threaded fasteners are colored silver and metric threaded fasteners are colored black. DO NOT mate silver and black fasteners to each other or the threads of either or both will be destroyed. Metric threaded HP-IB cable lockscrew illustration and part number follow.



Logic Levels

The Hewlett-Packard Interface Bus logic levels are TTL compatible, i.e., the true (1) state is 0.0V dc to 0.4V dc and the false (0) state is +2.5V dc to +5.0V dc.

Mating Connector

HP 1251-0293; Amphenol 57-30240.

Mating Cables Available

HP 10631A, 1 metre (3.3 ft.), HP 10631B, 2 metres (6.6 ft),
HP 10631C, 4 metres (13.2 ft.), HP 10631D, 1/2 metre (1.6 ft.).

Cabling Restrictions

1. A Hewlett-Packard Interface Bus System may contain no more than 2 metres (6.6 ft.) of connecting cable per instrument.
2. The maximum accumulative length of connecting cable for any Hewlett-Packard Interface Bus System is 20.0 metres (65.6 ft.)
3. The maximum number of instruments in one system is fifteen.

Figure B-2. Hewlett-Packard Interface Bus Connection.

HP-IB Address Selection

The HP-IB device address of the HP 5372A is selected from the front panel through the System menu. The address applies to both the talk and listen functions. The selectable addresses are from 0 to 30. Instructions for selecting the address are provided in chapter 12, "System Menu," of the *Operating Manual.*

The device address is retained in non-volatile memory. If the battery or memory fails, the address defaults to "3".

HP-IB Descriptions

A description of the Hewlett-Packard Interface Bus (HP-IB) is provided in the *HP5372A Programming Manual.* Study of the information in the Programming Manual is necessary if you are not familiar with HP-IB concepts. Additional information concerning the design criteria and operation of the bus is available in IEEE Standard 488-1987, titled *Standard Digital Interface for Programming Instrumentation.*

RACK MOUNTING KITS

The available rack mount kits are:

- Option 908 Rack Mount Flange Kit — without front carrying handles
- Option 913 Rack Mount Flange Kit — with front carrying handles

In the Option 908 rack mount kit, handles are not supplied; thus, this rack mount kit supplies the hardware required to mount the HP 5372A in a standard rack with the flanges only. In the Option 913 rack mount kit, handles are supplied; thus, this rack mount kit supplies the hardware required to mount the HP 5372A in a standard rack with flanges and handles.

The rack mounting contents and detailed installation instructions are provided with each rack mount kit. If a kit was not ordered with the instrument, it can be ordered through your nearest HP Sales and Support Office by using the following part numbers: HP Part Number 5061-9678 for Option 908 and HP Part Number 5061-9772 for Option 913.

A Rack Slide-Mount Kit (HP Part Number 1494-0059) is also available. The rack slide lessens the need to lift the HP 5372A, which weighs 25.4 kg (56 lbs).

STORAGE AND SHIPMENT

Environment

The instrument may be stored or shipped in environments within the following limits:

TEMPERATURE . . . . . – 40° to 75° C (– 40° to 167° F)
HUMIDITY . . . . . .Up to 95%
ALTITUDE . . . . . .15,240 meters (50,000 feet)

The instrument should also be protected from temperature extremes which cause condensation within the instrument.

Packaging

ORIGINAL PACKAGING

Container and materials identical to those used in factory packaging are available through Hewlett-Packard for servicing; attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

OTHER PACKAGING

The following general instructions should beused for repacking with commercially available materials:

a. Wrap instrument in heavy paper or plastic. If shipping to Hewlett-Packard office or service center, attach tag indicating type of service required, return address, model number, and full serial number.

b. Use strong shipping container. A double-wall carton made of 2.4 MPa (350 psi) test material is adequate.

c. Use a layer of shock-absorbing material 70 to 100 mm (3- to 4-inch) thick around all sides of the instrument to provide firm cushioning and prevent movement inside container. Protect control panel with cardboard.

d. Seal shipping container securely.

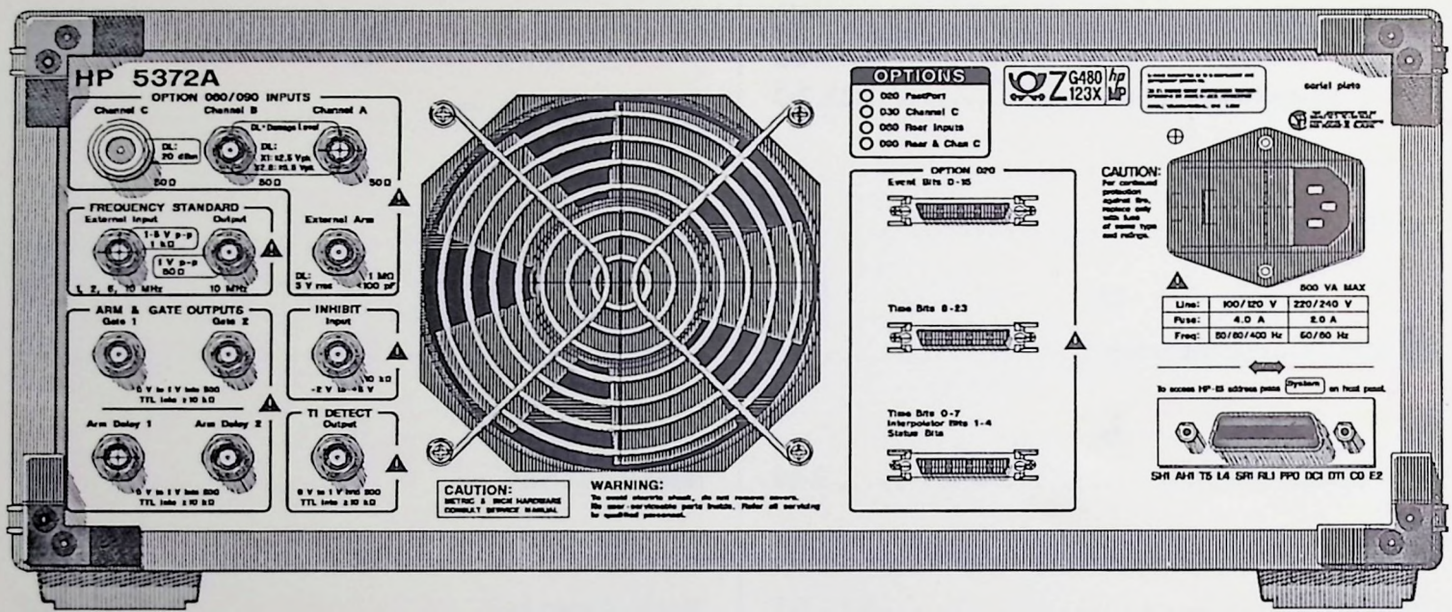
e. Mark shipping container FRAGILE to ensure careful handling.

f. In any correspondence, refer to instrument by model number and full serial number.

Index

HP 5372A REAR PANEL

(With Option 090 and 020 installed)



HP 5372A Function and Arming Summary

ARMING MODE	MEASUREMENT FUNCTION													
	TIME INTERVAL OR HISTOGRAM TI		CONTINUOUS TIME INTERVAL OR HISTOGRAM CTI	± TIME INTERVAL OR HISTOGRAM ± TI		FREQUENCY, PERIOD		TOTALIZE		POS WIDTH NEG WIDTH RISE TIME FALL TIME DUTY CYCLE	PHASE	PEAK AMPLITUDE	PHASE DEVIATION	TIME DEVIATION
	A	A→B	A	A	A→B	A	DUAL[1]	A	DUAL[1]	A	A rel B	A	A	A
	B	B→A	B	B	B→A	B	RATIO[2]	B	RATIO[2]		B rel A	B	B	B
						C	SUM[3]		SUM[3]					
							DIFF[4]		DIFF[4]					
AUTOMATIC														
AUTOMATIC	C*	C*	C*		C*	C*	C*			C*	C*	N*	C*	C*
HOLDOFF														
EDGE HOLDOFF	C	C	C		C	C					C		C	C
TIME HOLDOFF	C	C	C			C								
EVENT HOLDOFF	C	C	C			C								
SAMPLING														
INTERVAL SAMPLING	C	C	C		C	C	C	C*	C*		C		C	C
TIME SAMPLING						N								
CYCLE SAMPLING						C								
EDGE SAMPLING						C	C	C	C					
PARITY SAMPLING					C									
REPET EDGE SAMPLING	C	C	C		C									
REPET EDGE-PARITY SAMPLING					C									
RANDOM SAMPLING	C	C			C									
HOLDOFF/SAMPLING														
EDGE/INTERVAL	C	C	C		C	C	C	C	C		C		C	C
EDGE/TIME						N								
EDGE/EDGE						C		C	C					
EDGE/CYCLE						C								
EDGE/EVENT				N	N	N								
EDGE/PARITY					C									
EDGE/RANDOM	C	C			C									
TIME/INTERVAL						C		C						
TIME/TIME				N	N	N								
EVENT/INTERVAL						C								
EVENT/EVENT				N*	N	N								
EXTERNALLY GATED						C		C	C					
MANUAL								N	N					

Symbol C or N indicates that a measurement can be made using the corresponding combination of Function, Channel, and Arming selections.

C = Continuous Arming, (Block/Sample Arming)

N = Non-Continuous arming, (Start/Stop Arming), setups are limited to M blocks of 1 measurement.

1. DUAL. Simultaneous Dual-channel, (2 results). Frequency and Period options are: A&B, A&C, B&C. Totalize option is: A&B.
2. RATIO. Frequency and Period ratio options are: A/B, A/C, B/A, B/C, C/A, C/B. Totalize ratio options are: A/B, B/A.
3. SUM. Frequency and Period sum options are: A+B, A+C, B+C. Totalize sum option is: A+B.
4. DIFFERENCE. Frequency and Period difference options are: A–B, A–C, B–A, B–C, C–A, C–B. Totalize difference options are: A–B, B–A.

* = Default Arming

ARMING CATEGORIES

Category	Continuous Arming Modes	Non-Continuous Arming Modes
Automatic	Block Holdoff is Automatic Sample Arm is Automatic	none
Holdoff Modes	Block Holdoff is User-defined Sample Arm is Automatic	none
Sampling Modes	Block Holdoff is Automatic Sample Arm is User-defined	Start Arm is Automatic Stop Arm is User-defined
Holdoff/Sampling Modes	Block Holdoff is User-defined Sample Arm is User-defined	Start Arm is User-defined Stop Arm is User-defined

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Hewlett-Packard Company
Intercontinental Headquarters
3495 Deer Creek Rd.
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Printed in U.S.A.
05372-90010